SCIENTIFIC AMERICAN

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THE NEW CROTON DAM.

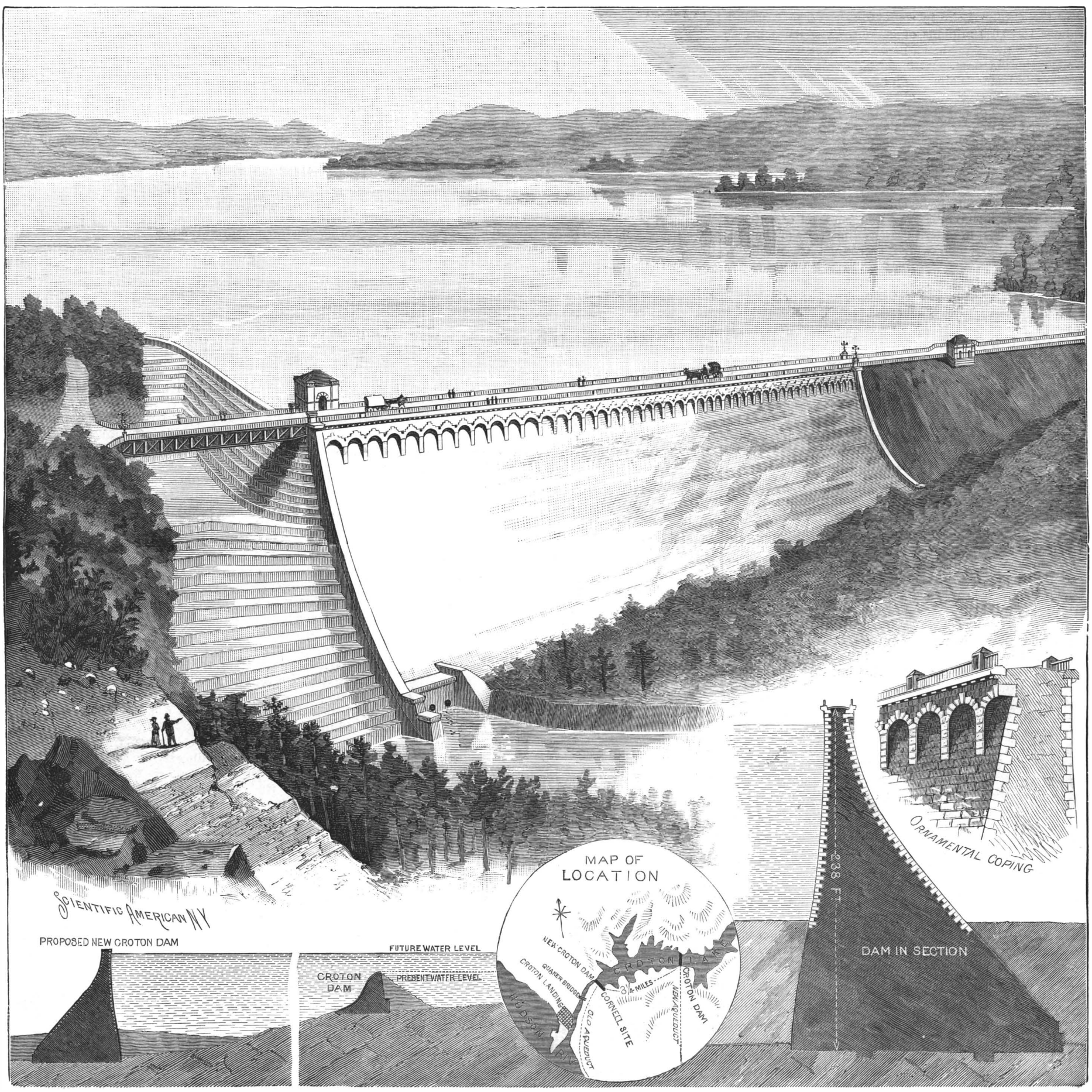
For some years it has been apparent that an increased reservoir capacity for the water supply of the city of New York was soon to be a necessity. To provide this the Quaker Bridge dam was proposed some years ago. This gigantic structure seemed almost in advance of the needs of the case, and the engineer of the aqueduct commission, M. A. Fteley, proposed as a substitute a high dam as close to the present Croton dam as possible, and immediately below it. Eventually a compromise site was chosen—what is known as the Cornell site—about half way between the present Croton dam and Quaker Bridge. Contractors' estimates for the construction of the dam will soon be before the authorities, and full plans have been prepared illustrating the details of its formation.

The dam is a combined masonry and earthwork structure. As shown in our cut, the portion on the extreme right is of earthwork. A section of this part shows an earthwork embankment rising 120 feet above the original ground level. Its apex is 30 feet wide, providing a 20 foot roadway. The slope of the sides is 2 horizontal to 1 vertical. This slope is made virtually flatter on the outside of the dam by a number of gutters, which run along the face to catch the drainage. This side is sodded.

The lower portion of the inner face is paved, 12 inches of broken stone acting as a basis for 18 inch thick paving blocks. For a considerable space above and below the water level, 18 inches of broken stone underlying 2 feet paving blocks is specified.

The earthwork is to be laid in 6 inch layers, each layer watered and rolled with grooved rollers. In a sample section the elevation of the crest above the original ground level is given at 120 feet. The excavation for the base of the dam is carried down 125 feet below this point. This excavation, starting with a width of about 280 feet at the ground level, by slopes and steps is reduced to a trench 25 feet wide under the center of the dam. From this trench a core rises. This is to be built of rubble masonry, 18 feet thick at the base and rising to a height 4 feet above the water level. The core is battered to a width of crest of 6 feet. It rests upon the bed rock.

The masonry section which adjoins this portion corresponds with it in level of crest. An 18 foot roadway runs across it. The dam is of rubble masonry, going in some cases 80 feet below the surface. Along the



THE NEW CROTON DAM AND LAKE, FOR THE FUTURE WATER SUPPLY OF NEW YORK CITY.

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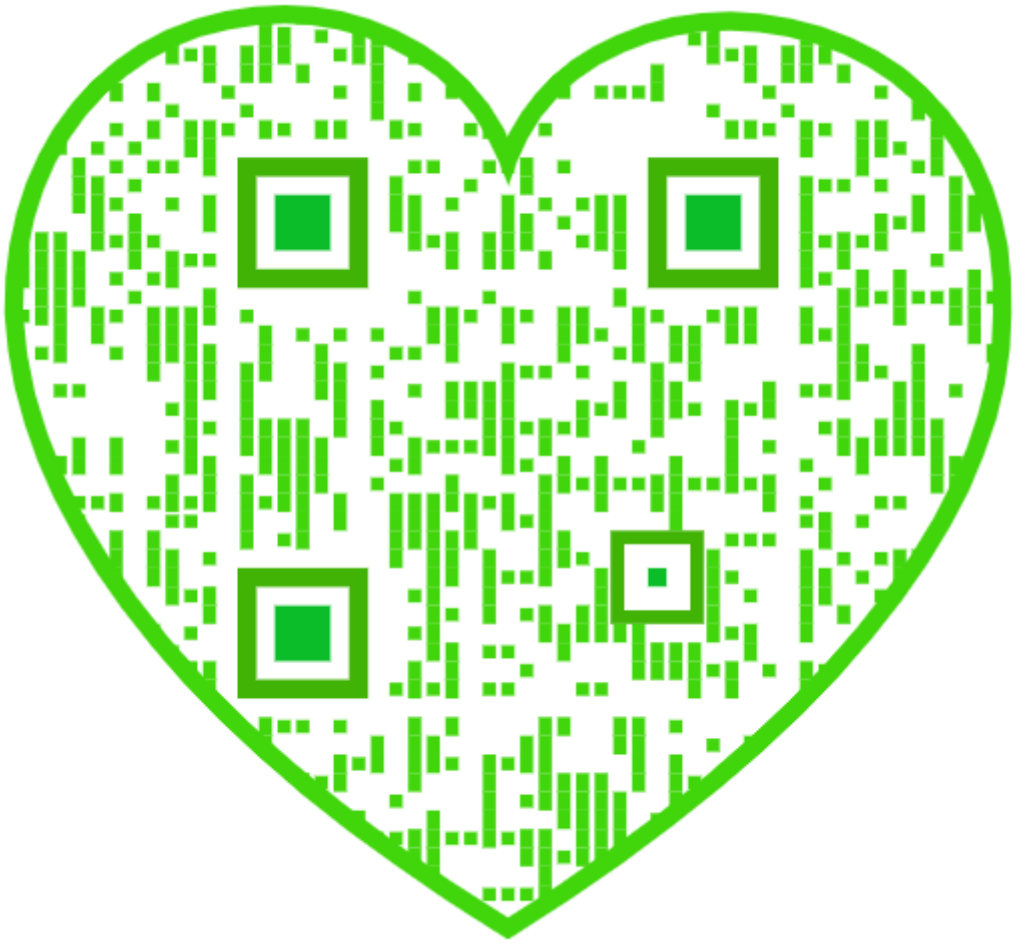

bottom of its excavation two trenches, 10 feet wide and 6 feet deep, are carried, into which the masonry descends, thus giving the great structure a definite resistance to horizontal thrust. The breadth of the masonry in some parts of the base is 185 feet. It is faced with cut stone. Its inner face slopes a little; the outer face, while varying in degree, has a general slope of 2 vertical to 1½ horizontal.

The dam proper is to be 1,200 feet long. Next to it comes the spillway, 1,000 feet long, over which the overflow takes place. This portion is built in a series of steps, and its level of crest determines the height of water in the dam. This crest is 24 feet below that of the dam proper, thus giving a margin of safety beyond any catastrophe.

In general construction the spillway is a masonry dam faced on the inner side with cut stone. The outer wall sloping outward is broken into a series of steps about 4 feet width and 5 feet rise. It is based upon the bed rock in exactly the manner described for the dam proper. It curves around as shown, and presents quite a striking appearance. Its peculiar shape enables a bridge to be carried over the gap to give passage to the highway.

The dam along its outer edge has a cornice of arches, an idea of whose appearance may be derived from the cut.

The work to be done by the dam is the formation of a larger reservoir than the present and the impounding of a quantity of the water which now at many times goes to waste, pouring over the crest of the present Croton dam. It will increase the storage capacity of the Croton Lake in round numbers from 2,000 millions to 30,000 millions of gallons. The main intake into the new aqueduct will be at the new gate house near the old dam. With the old aqueduct a connection will be made almost on a line with the new dam. Whether the section of old aqueduct intercepted will be preserved or not is still an open question. It may be used to deliver water back to the new gate house and thence into the new aqueduct.

The present Croton dam, and far back of it, Muscoot dam, will be submerged. The latter dam will cut off all water above it from the reservoir. Such water it is intended to use only in emergencies. The object of Muscoot dam is to preserve a uniform level of water as far as possible, in order to satisfy the desire of the residents of the region which surrounds its reservoir. Below the Muscoot dam 24,000 millions of gallons is the capacity of the new reservoir.

The watershed of the region feeding the new dam is 376·3 square miles. The estimated cost of the dam proper, as per engineer's report of October 8, 1890, is $3,650,000, to which must be added for roads, bridges, railroads, etc., $1,075,000, and for Muscoot dam $300,000. Six and one-half years are allowed for its construction. The dam, estimated to cost $400,000 less than Quaker Bridge dam, has only 4,000 gallons less storage. Its extreme height above the river bed is 159 feet, its extreme depth below the same is 80 feet, giving a total of 239 feet maximum height.

Estivation.

A rarer and even more curious phenomenon than hibernation, or winter sleep, is the estivation, or torpidity during the dry season, of certain animals. As one of the mammals which is most sensitive to heat and dryness, M. L. Cuonot mentions the tanrec, of Madagascar, an insect-eating creature resembling the hedgehog. It is very active during the rainy season, but lies torpid in a shallow burrow for nearly six months in the dry period. The most remarkable summer sleepers, however, are found in the group of dipnoids, intermediate between the batrachians and fishes, and comprising at present but three animals—the *Lepidosiren paradoxa* of the affluents of the Amazon, the *Protopterus annectens* of Gambia and Senegal, and the *Ceratodus Forsteri* of Australia. Their anatomical structure resembles that of the fishes, and a bronchial apparatus allows them to breathe in the water, while a pulmonary apparatus enables them to absorb the oxygen of the air. A careful study of the protopterus shows that during the entire dry season, lasting about nine months, it remains buried in the dried-up mud at a depth of five feet, and is surrounded by a sort of cocoon, which incloses it hermetically. Air penetrates through a narrow channel to the animal, which in this state breathes, not only through a lung into which the swinning bladder is transformed, but through its wide membraneous tail. On the return of the rainy season, the dried mucus covering the animal dissolves, and the creature straightens out from its doubled-up position, and swims in the water for three months.—*Mediterranean Naturalist.*

THE tide tables for the Atlantic coast of the United States, together with 206 stations on the Atlantic coast of British America, for the year 1893, published by the U. S. Coast and Geodetic Survey, are now ready for issue, and copies can be obtained at the agencies of the Survey in this city, or by addressing the office at **Washington. Price twenty-five cents.**

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THE NICARAGUA CANAL.

The assertion is sometimes made that the Nicaragua Canal will not benefit us in regard to the increase of the number of our ships, and this assertion is based on the fact that France failed to add a single ship to her carrying fleet by the completion of the Suez Canal, built by French engineering, French enterprise and French capital. This fact is brought forward as a lesson in history which we must bear in mind when we are asked to consider the Nicaragua Canal question as an element in the development of our commerce.

At the present day the Suez Canal is chiefly devoted to the carrying trade of England, and England owns a fighting interest in the stock.

We hold in regard to the Nicaragua Canal that the United States will, no matter who builds it, take the same position that England could not fail to attain in the use of the Suez Canal. England possesses an immense, flourishing and steadily increasing commerce in the East, while the commercial possessions of France there are comparatively small.

Like England in the East, we have extensive possessions in the West on our Pacific shore, California, Oregon, Washington and Alaska, all very flourishing, while their productiveness is steadily increasing. It must, without fail, stimulate our shipbuilding trade when by a shorter and safer transit the mutual commerce will receive a most powerful impulse. All the European ocean-faring nations are even more interested in the Nicaragua Canal than in the Suez Canal, because by passing it they will avoid the stormy ocean of the extreme southerly coast of South America, the sailing round which is a great deal worse than sailing around the Cape of Good Hope.

There ought to be no doubt that our government will assist the enterprise. It is in duty bound to do so. Even in the view of national defense we must have a shorter waterway for more rapid and safer navigation between our extensive eastern Atlantic and western Pacific shore, and so dispense with the delay and danger of a long, roundabout way of sailing around the whole South American continent over the two grand oceans of our globe.

OF INTEREST TO ELECTRICIANS.

By years of exposure to atmospheric temperature, hardened steel loses hardness.

Steel magnets lose their permanent magnetism at the boiling point of almond oil.

Steel not only loses its magnetism, but becomes non-magnetic when heated to an orange color.

Silvanus Thompson says that the sudden slamming on of the armature of a permanent magnet is liable to deteriorate the magnetism; and that the sudden detaching of the armature is of advantage to the magnet.

In the storage battery the plates intended for the positive are pasted with red lead and dilute sulphuric acid (acid 1 part, water 9), and those to be used for negatives with litharge and dilute sulphuric acid.

The positive plates of a storage battery when fully charged should look like wet slate, nearly black; when partly charged they are dark red, chocolate or plum color. The negative plates are always much lighter than the positives and have a pale slate color.

Too quick a discharge buckles the plates and a very sudden discharge draws the paste out of them. When fulled charged plates which have been removed from the electrolyte are to be replaced, the liquid put in should have the same specific gravity as it was before.

According to Silvanus Thompson, a simple tangent galvanometer may be made to read as an ampere meter when constructed as follows: "Take a piece of insulated copper wire of a gauge not less than No. 10 B. W. G., or say than three millimeters in diameter, and of this wire wind five turns only, so as to have a mean radius for New York, Cleveland and Chicago of 6·72 inches; for Philadelphia, 6·37 inches; Washington, 6·18 inches; San Francisco, 4·85 inches; New Orleans, 4·42 inches; then such a coil when traversed by one ampere deflects the needle exactly 45°, that is, to the angle whose natural tangent = 1, and the natural tangents of the deflections will therefore read amperes directly. The radius has to be inversely proportional to the intensity of the horizontal component of the earth's magnetic force at the place where the ampere meter is to be used. It may be further noted that a current of one ampere strength will cause the deposition in one hour of 1·174 grammes or 18·116 grains of copper in an electrolytic cell. It will in one hour deposit 4·024 grammes or 60·52 grains of silver in a silver cell.

THE exposition is deriving quite a revenue from the visitors whose curiosity prompts them to see the grounds and the wonderful buildings now approaching completion. An admission of twenty-five cents is charged, and on single days the number of visitors has exceeded 14,000. With cooler and more pleasant weather, it is believed, the visitors will be much more numerous. Without exception all are enthusiastic in their admiration and wonder at the magnificent spectacle.

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Stevens Institute.

We recently presented a series of engravings illustrating some of the special departments of this important institution of learning. The following abstract from the remarks by Mr. S. B. Dod, President of the Board of Trustees, at the commencement of the Stevens Institute of Technology, June 23, 1892, contains an epitome of the use, progress, and prospects of the establishment :

The question with us is, not how to get students to come, but how to take care of those who crowd at our doors for admission.

It was easy to provide for the first class which graduated in 1873, for it was composed of only one man ; it is harder to meet the requirements of the 120 men who will seek entrance to Stevens next fall. But the trustees are planning to do this, and, with the help of our friends, they will do it. They propose to raise the roof of the extension on the north and add two stories to it, and so take care of the class that will come to us next fall. The alumni have generously contributed $17,000 toward the new chemical laboratory, and, when the balance of $33,000 is subscribed, the trustees will go on with that building; and so we shall be able to take care of future classes.

What we have done in the past assures us of the future. We have graduated nineteen classes of men who are able to take their places in the world with such credit to themselves and their alma mater that I have been repeatedly assured by men in management of large and important industrial works that they need no higher commendation of a man than the diploma from Stevens.

And now this twentieth class comes to us for their degrees, a solid phalanx of high standing, a class of thirty-nine, without a single condition.

We want our friends to know that we are ready and anxious, if the means are placed in our hands, to give to all who ask it this thorough education.

And I have the pleasure of announcing that, at the recent meeting of the trustees, President Morton presented to the institute the sum of $20,000 for the further endowment of the chair of engineering practice.

This is not the first of President Morton's gifts to the institute. He gave $10,500 toward fitting up the workshop ; $2,500 for the department of applied electricity; $10,000 for the endowment of the chair of engineering practice, and now this $20,000 to the same chair.

The sum total of these gifts amounts to nearly $50,000, and perchance exceeds that sum if we reckon the many smaller but constant gifts, not set down in the books, with which he tided over this or that minor deficiency in the various departments.

But generous as he has been in his gifts of money, he has given far more than these—he has given his brains. his heart, himself, to Stevens, with untiring devotion.

This is oftentimes more value than all else—of a value, indeed, that cannot be measured by the lower standard of dollars and cents.

What Stevens is to-day, she owes to Henry Morton. The course of education which is to be for you, young men, a priceless blessing through your life, you owe to him.

If I seem to violate the ancient maxim that it is not fitting to sacrifice to heroes until after sunset, my excuse is this: that, in the literal sense, it is after sunset; but in the metaphorical sense, I do not want to see the day when it shall be sunset for our honored president.

I know that I voice the sentiment of every loyal son of Stevens when I say: "Long live Stevens!" and long live Henry Morton, her first and foremost president !

The Peary Relief Expedition.

As was contemplated last year, when Lieutenant Peary set out on his Greenland exploring expedition, a relief party, taking further supplies for the explorers, or with the design of bringing them home if their work was completed, sailed from New York June 27. The relief party includes Professor Angelo Heilprin and Henry G. Bryant, of the Philadelphia Academy of Natural Sciences; V. W. Stokes, artist; Dr. Jackson M. Mills, surgeon; Albert W. Vorse, William E. Meehan, botanist; C. E. Hite, taxidermist, and Samuel J. Entriken. The party, with all manner of stores useful for Arctic travel, left by steamer for St. Johns, Newfoundland, expecting to sail from there for Greenland on July 5, making the voyage on the Kite, a small and staunch steam vessel, which took out the Peary party last year.

The first stop will be made at Godhaven, Disco Island, from there the vessel proceeding to Melville Bay, and thence to Inglefield Gulf, at the head of Whale Sound, which was the base from which Lieut. Peary intended to start out upon his overland explorations. It was Lieut. Peary's intention, it will be remembered, to winter comfortably in well established quarters in this neighborhood, starting northward in the early spring on snow shoes and sledges over the inland ice to Humboldt Glacier, thence to the head of Peterman Fjord, to Sherard Osborn Fjord, to De Long Fjord, and to such further northern limit as possible, to define the coast line of northern Greenland, supply depots being left on the route for assistance on the return journey.

The exploration was undertaken upon the assumption that the interior of Greenland is covered with an uninterrupted ice cap, which the explorer thought might be thus traversed in one season, the party returning to Whale Sound in time to be taken up and brought home by a vessel reaching there by July or August of this year, although the possibility of a further stay of the explorers over another year was contemplated. Should the conditions prove favorable, the scientists of the relief party intend to examine the Humboldt Glacier, and hope to fall in with Lieut. Peary and his party early in August. The return cannot be delayed much beyond this date, in any event, the relief party not expecting to be away later than the last week in September. If Lieut. Peary and his party are not brought back, fresh supplies will be left for their maintenance in their northern exile another winter, should this be unavoidable.

The Old and New Scientific Spirit.

A writer in *Industries* of June 3, under the initials "W. M. M.," writes as follows:

"About 200 years ago a young man, whose name is still held of some account, was engaged in the work of verifying by calculation a theory of his own respecting the curve of the moon's motion in its orbit. There was a discrepancy of 14 or 15 per cent between the observed and calculated results, and consequently he laid aside at that time any further consideration of the matter. Recently the members of the Physical Society assembled in force to hear another young man, whose name is now held of some account, give a statement of the evidence for and against the theory that the earth carries the ether with it in its motion round the sun. The lecture was illustrated with many diagrams of experiments, mostly negative or inconclusive in their results. *Inter alia* there was a diagram of observed and calculated results, showing a discrepancy of about 99 per cent. But science has advanced since Newton's time, and the last thing any modern scientific man would think of doing is to 'lay aside all further thought of this matter' on account of a trifling discrepancy of this sort. There is a good deal to be said for this modern view. Newton was right after all, and a too scrupulous delicacy might have caused him to miss his greatest discovery and the *kudos* attached to it. Adams first calculated the position of Neptune, but Le Verrier published first; and your modern man does not mean to be caught napping so, even if he has to publish before finishing his calculation. Does not Mayer share with Joule in the opinion of half the world the credit of the theory of the conservation of energy, and who would have heard of him if he had stopped to verify? We are even told that it is little short of a crime to 'hide the light that is in us,' no matter how feeble and flickering it may be, lest haply some one greater should waste his strength collecting and arranging the uncompleted work, as Maxwell did for Cavendish. And yet—and yet—the *Principia* will endure for all time : will 'Modern Views of Electricity,' with its choice of inconsistent hypotheses, or 'Electro-magnetic Theory,' with its *rational* (?) system of units, its uncouth phraseology, and its petulant contempt for whatever is not brand new, stand such a test? A bigot for classical education, with an insufficient appreciation of Newton's genius, attributes his superiority in part to the fact that he published in Latin. 'You may think any scientific nonsense you please,' says this misguided person, 'and you may write it down readily enough in English ; but you can't put it into Latin, nor, easily, into French. If it goes readily into German, it is probably more scientific and worse nonsense than usual.' But that, of course, is absurd. In these days it is often almost as good a deed to kill a false hypothesis as to establish a true one ; and for this purpose the publication of negative results is most useful, nor is it contrary to precedent. Kepler gave his failures to the world, but only after he had arrived at the truth ; Faraday gives his negative results, but he draws the logical inference from them. In each case we could ill spare the insight obtained into the mind and method of a genius. A reasonable rule might be laid down that only those who succeed are entitled to show where they have failed ; but then how meager would be the reports of our scientific societies!"

Desert Mirage in the Class Room.

R. W. WOOD.

Some days since, I noticed a remarkably striking example of true desert mirage on a smoothly paved sidewalk, on which the hot afternoon sun was shining. The walk was perfectly level, paved with smooth white slabs of artificial stone, extending in a horizontal direction along the top of a steep hill. On coming up the ascent the eye could be brought nearly on a level with the sidewalk, by standing just below the brow of the hill. A curious phenomenon presented itself. The walk appeared to be flooded with water, on the smooth surface of which could be seen the reflected images of lamp posts, pedestrians, etc. A small poodle dog trotting along above his inverted image presented an amusing spectacle. So perfect was the illusion that, for a moment, I could hardly believe that the walk was not wet. I have since noticed the phenomenon every day, and find that whenever the eye can be brought nearly on the plane of a smooth, level surface of stone paving or asphalt, on which the sun shines brightly, these refracted images can be seen.

It occurred to me that possibly the effect could be produced in the class room. A preliminary experiment with a hot kitchen stove convinced me that the plan was feasible, and I found that if a strip of thick sheet iron, five or six feet long, four or five inches wide, supported so as to be perfectly level, be heated by a number of Bunsen burners from beneath, a miniature mirage can be seen by bringing the eye on a level with one end of the strip, and viewing a candle flame that burns on a level with the other end. The candle should be held below the strip, so that only the flame is visible above the edge. If the cold iron shows a reflection due to its polished surface, it may be sprinkled with fine sand. Obviously the surface of the sand must be made level. The effect can be heightened, if the apparatus works well, by using a small palm tree an inch or so high cut from paper and colored to life, which is more realistic and suggestive of the desert. The cause of the phenomenon is, of course, apparent to any one versed in the laws of optics. The rays of light, on striking the layer of warm (and consequently less dense) air, are refracted upward without striking the ground at all. This gives the appearance of a reflected image, and the natural inference would be that it was due to water. On the desert the layer is hot enough and thick enough to bend up the rays sufficiently to enable a person standing upon level ground to see them, but under the less favorable conditions offered by the city sidewalk, the refraction is so slight that the eye has to be lowered considerably to observe the effect.

San Francisco, June, 1892.

Relief from the Mississippi Floods.

W. J. Smith, civil engineer, of Toronto, Canada, has proposed a novel way of diverting the flood waters of some of the great affluents of the Mississippi. His plan is to cut a channel from the Red River near Shreveport to the nearest available point on the Sabine River, a distance of about 25 miles, with a water area of 1,000 feet, with an estimated flow of 7,200,000 cubic feet per hour. Estimated cost, $3,000,000. A further relief by a channel 125 miles long from the Arkansas to the Red River, near the boundary line of the Indian Territory, and 300 miles further on through the eastern border of Kansas, to tap the Missouri River near Kansas City. On the eastern side of the Mississippi the scheme is to connect the Tennessee with the Gulf through the Tombigbee River and the Yazoo through the Pearl River, and thus divert 20,000,000 cubic feet of flood water per hour from the Lower Mississippi, at an estimated cost of about $85,000,000.

The scheme is a grand one, with the exception that it does not deal with the topography of the country through which the great waterways are to flow, nor the relative elevation of the rivers to be connected. There are large areas of elevated land between the Missouri and Arkansas, with a mountain divide, and a ridge of hills between the Arkansas and Red Rivers. The divide between the Red River and the upper waters of the Sabine indicates deep and costly cutting with the uncertainty of the required flow through 150 miles of the Sabine River. The connecting waterways on the east side of the Mississippi are of the same vague character as to the topographical difficulties.

The New York Building at the World's Fair.

The board of managers for the State of New York has decided upon the plans and ordered work to be immediately commenced upon the New York building at the Columbian Exposition. The accepted design was made Messrs. McKim, Meade & White, and is in the style of the Italian Renaissance, three stories, with porticoes at each end, to be surmounted by two campaniles. The building will be 60 feet high, 200 feet long and 105 feet deep. The material used in the construction will be staff, a composition of plaster of Paris, cement and hair, which gives the general effect of marble.

Government Aid for the Fair.

In the U. S. Senate an appropriation bill for the Fair has been favorably reported, and its passage and approval by the President is virtually assured. It is practically the same as that agreed upon by the House of Representatives, and makes an aggregate appropriation of $5,541,495, including an issue of 10,000,000 silver half dollar souvenir pieces, and appropriations for the procurement of medals and diplomas, expenses of the government exhibit, additional employes, etc. The committee included in the bill an amendment requiring the Exposition to be closed on Sundays.

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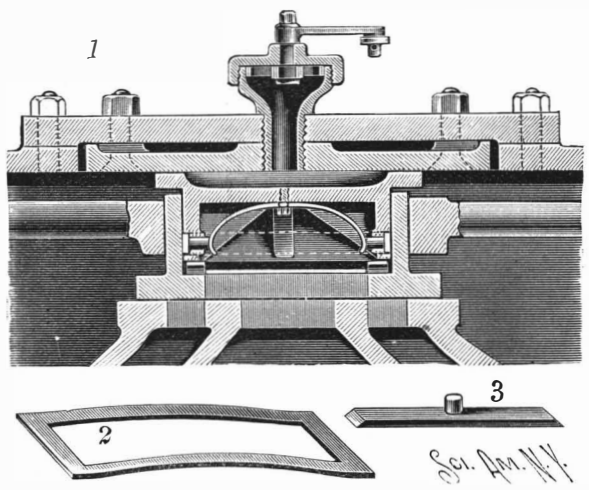
AN IMPROVED BALANCED SLIDE VALVE.

A slide valve of simple and durable construction is shown herewith, the illustration being made from a drawing of a valve fitted on a locomotive running on the imperial government railways of Japan, a six-wheeled coupled tender engine, wheels 4 feet diameter, cylinders 16 by 22 inches, and boiler pressure 160 pounds per square inch. The improvement has been patented by Mr. John McDonald, of the Railway Shenbasi, Tokio, Japan. The valve is formed with an open top, in which slides vertically a crown plate or cover adapted to be pressed by back pressure of the cylinder in contact with the face plate held on the



McDONALD'S BALANCED SLIDE VALVE.

steam chest cover. In the middle of the cover is a valve which opens into the steam chest over the space covered by the crown plate, the valve opening to the atmosphere when the live steam is shut off from the steam chest, whereby all vacuum in the cylinder is destroyed. In starting, there is ordinarily a momentary puff of steam, until the crown plate rises, and the operator can observe whether the valve is working balanced or unbalanced, according to the escape or non-escape of steam, a lever or link enabling the operator to close the openings of the valve as desired, when the improvement works like an ordinary slide valve. Fig. 3 represents the packing strip held by a curved spring in the end and side walls of the crown plate, and Fig. 2 is a spring preferably used, but not considered essential, to keep the crown plate against the upper face plate. It is said that one locomotive in Japan, provided with one of these valves, has run over 38,000 miles, showing no wear whatever, the trials thus far being so successful that other locomotives are being fitted with the improvement. An especially valuable feature of the device is that it automatically opens the cylinders to the atmosphere when the engine is running without steam, so that there is no vacuum created and no tendency to suck smoke and ashes into the cylinders.

A New Use for Bamboo.

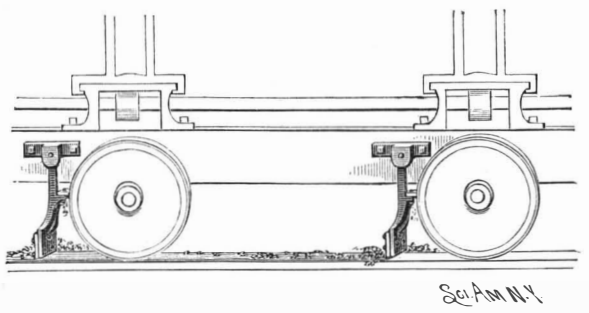
A new application of the stems of the larger growing species of bamboo has recently been adopted in China for the manufacture of small trays and ornamental articles for export to Europe. It is known in China as bamboo sheeting, and it is said to be carried on at present only to a limited extent at Wenchow, where, notwithstanding that it is quite a new trade, about ten firms are now engaged in it. The process adopted is as follows: A length of bamboo is cut off, and then pared with an ax till it is of the thickness required. It is next planed with a spokeshave, and the thin cylinder so obtained is slit up, so that, on being opened out, it forms a sheet. A number of these cylinders, placed one inside the other, are immersed in boiling water for a few minutes, to render them flexible, and they are then unrolled and flattened out, by being subjected to pressure under heavy stones. These sheets are sometimes used for making fretwork and carved screens, fans, etc.; and the small, pale, straw-colored pin trays, for toilet tables, which appeared in the London shops last season, are apparently made from this specially prepared bamboo. It seems to adapt itself extremely well for moulding into many forms, and might be made available in this country for various kinds of veneering. The bamboo now appears to be the *Dendrocalamus latiflorus.*

Calomel in Hemorrhoids.

For a number of years Dr. J. B. James, of London, has treated hemorrhoids by the simple process of applying calomel to them with the finger, and claims to have done so with marked success in every case, particularly when the hemorrhoidal mass was inflamed, which is characterized by mucous discharge and hemorrhage, accompanied with a painful sensation of weight in the region of the rectum. All these symptoms, it is alleged, were speedily relieved by the simple application of the calomel, which had the still more important subsequent advantage of restoring the patient to perfect ease, enabling him to pursue his usual occupations in happy immunity from all distressing or annoying symptoms.

A SCRAPER FOR SAWMILL CARRIAGES.

A cheap and simple device to be attached to the carriage of any kind of a sawmill, to scrape the track and the wheels, so that both will be kept clean and the carriage will run smoothly, is shown in the accompanying illustration. The improvement has been patented by Mr. Charles M. Cronkhite, of Kimball, Wis. Near each wheel and to one side of the carriage is secured a hanger from which the body of the scraper is suspended, upon a pin extending through a vertical slot in the upper end of the body, allowing for the vertical movement of the scraper. On the front face of the lower end of the body is a steel wear plate having a beveled lower edge, adapted to run upon the track and scrape off sawdust, pitch, etc., the plate being adjustably fastened in position by screws, so

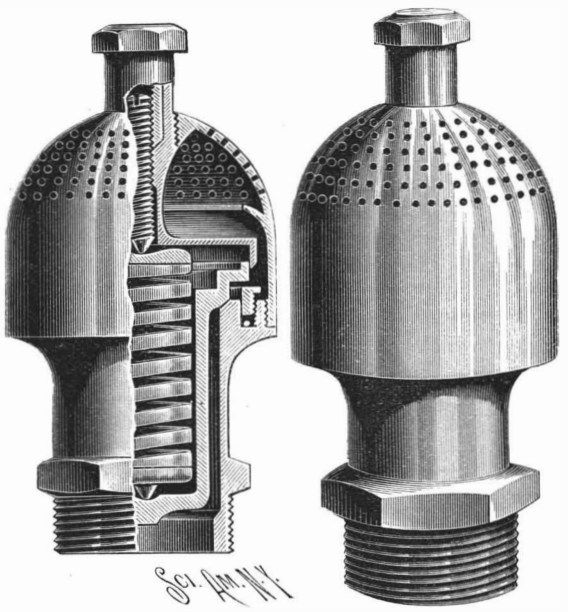


CRONKHITE'S SCRAPER FOR SAWMILLS.

that its position may be changed as it becomes worn. On a projecting ledge of the body is also secured a similar wear plate adapted to bear against the face of one of the wheels. When the carriage is moved forward the scrapers bear upon the track and wheels, and when it is moved in the opposite direction the scrapers swing freely on their pivots.

AN IMPROVED SAFETY VALVE AND MUFFLER.

The illustration represents a simple and durable valve designed to permit the ready escape of the steam, while the steam will be so expanded and the currents so broken up before reaching the atmosphere that the improvement forms an efficient muffler. The invention has been patented by Mr. Erastus B. Kunkle, of Fort Wayne, Ind. In the valve body is a spring pressed cup valve, held in lowermost position by heli-

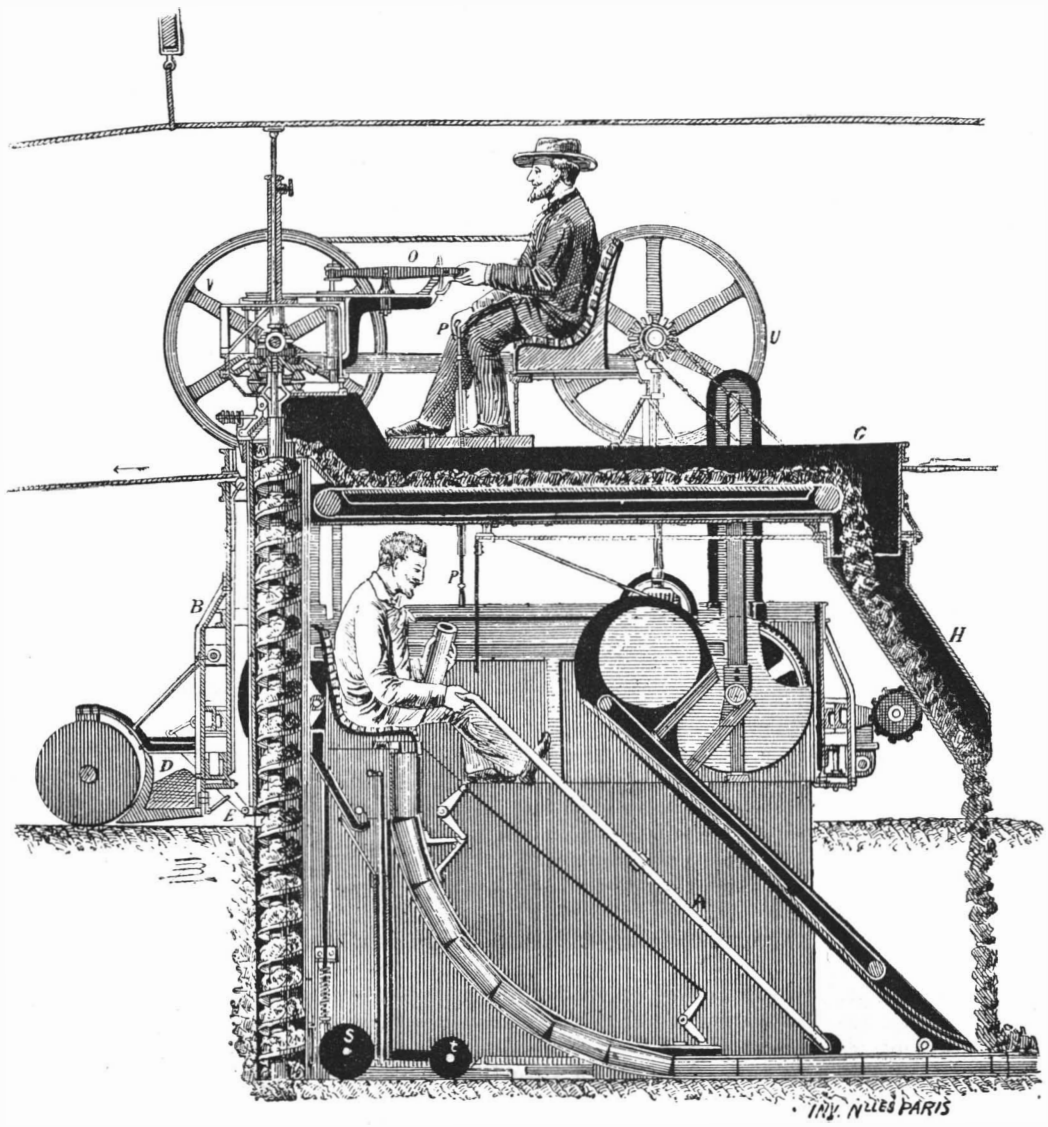


KUNKLE'S SAFETY VALVE AND MUFFLER.

coidal springs, the tension of which is regulated by a screw in a hub of a semi-spherical cap, provided with perforations, and screwing on a flange of the valve body outside of the valve seat. The hub of the cap has at its lower end a disk, there being a passageway for escaping steam between the wall of the cap and the edge of the disk, and a downwardly extending annular flange on the outer edge of the disk fits upon an annular flange of the cup valve. Directly below the latter flange is a ring screwing in an interior thread in the valve body to regulate the size of the steam passage outside the valve seats, and provision is also made for the escape of any steam passing into the cup valve. An annular curved lip, on the inside of the cap, extends upward and inward over the edge of the disk at the lower end of the hub, the lip guiding the escaping steam toward the center of the cap, so that the currents are broken up before the steam passes out to the atmosphere through the perforations of the cap. It is designed that, with this form of valve, the noise will be so reduced as to be hardly perceptible.

MACHINE FOR LAYING DRAINAGE PIPES.

The laying of drainage pipes is always a costly operation and consumes considerable time. It is generally effected in three operations, the first of which consists in digging the trench, the second in putting the pipes in place by hand, and the third in covering them with earth. The machine represented herewith is designed to perform these various operations at the same time, and with the aid of two men only, thus notably reducing the cost of installation.



MACHINE FOR LAYING DRAIN PIPES.

It consists of a frame, A, mounted upon wheels, which rest directly upon the ground, or, by preference, upon rails that are taken up and laid again in front in measure as the work progresses. This frame supports another one, B, which carries the tool designed to excavate the trench, and which is nothing else than an endless screw, with cutting edges, arranged vertically. This screw is protected laterally by two plates that support the earth and prevent it from falling into the trench before the pipes have been laid. In the part of the screw that projects above the level of the earth a third plate, placed in front, prevents the earth accumulated upon the spirals from falling upon the ground. This plate is not fixed, but is held against the screw by a lever, E, and a counterpoise, so that if the screw brings up a large stone, the latter can enter the passageway thus formed.

The motion forward, as well as the motion of the screw, is produced by a cable winding over a

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wheel, U, and ending at a stationary engine placed at one end of the field. The starting or stopping is effected through a lever, P, placed within reach of the hand of the two operators. In measure as the machine moves forward, the operator at the lower part puts pipes into the curved cylinder which extends to the bottom of the machine, and the pipes are thus laid upon the ground, one after the other. The earth, on reaching the upper extremity of the screw, is emptied upon an endless cloth in the box, G, whence it falls into the passage, H, which may be inclined to the right or left, so that the earth may be made to drop upon the pipes, or be deposited to the right or left of the trench.

In order to prevent the earth from entering the joints of the pipes, the joints are covered with a band of paper led to them by a guide seen at the back of the machine.

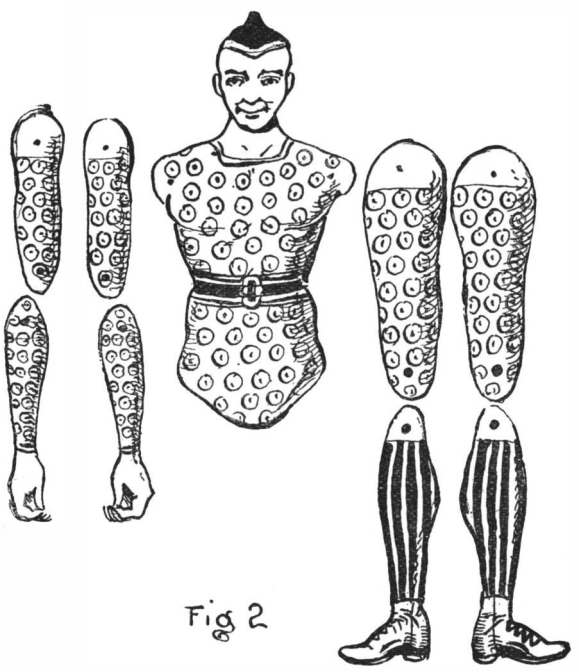
It may happen that the screw, in its operation, may meet with excavations deeper than the trench that it is desired to form, and that consequently the pipes may be insufficiently supported at such points. In order to remedy such a difficulty, there is arranged immediately behind the screw a drum, S, which bears constantly upon the ground, and against which abuts the extremity of the rod of a valve closing a box of sand. When the drum enters an excavation, the valve rod, actuated by a spring, lowers, and the valve leaves its seat and allows of the passage of a certain quantity of sand, which falls into a vertical chute situated behind the drum and fills the excavation. A second roller, *t*, equalizes this layer of sand, and the bottom of the trench is thus made perfectly level.—*Les Inventions Nouvelles.*

HOMOGENETIC ENUMERATION.

It has generally been supposed there are but two systems of numeration, the Arabic and the Roman. Here, however, is a third, which, for want of a better name, we will have to call homogenetic enumeration. In this system the limbs of the human body may be made to represent all numbers and their relations that can be expressed in the ordinary manner, and more concisely, for the use of ciphers is dispensed with.

The series consists of nine puppets that represent the nine digits by extending the left arm in different positions; first at a right angle to the body, then at an acute, and then at an obtuse angle. The elbow bent while the left arm extends at a right angle to the body gives a succession of the same angles, and at an acute angle another succession, making nine in all. The right arm extended in the same manner as the left gives a second period, that of tens. The left leg reversing the angles of the left arm represents hundreds, and the right leg reversing those of the right arm, thousands.

This series may be carried as much further as is desired by very simple devices, such as standing them upon their heads and making this equivalent to adding a requisite 10,000 to their value, adding hats of different patterns, which will give additional values; or by simply placing above or below the figures a horizontal, oblique, or vertical stroke; a right, acute, or obtuse angle; or in any way differentiating them from the first series here given. In order to represent any given number by means of these figures, it is first necessary to divide it into units, tens, hundreds, and thousands. Thus 1892 will not be represented as eighteen hundred and ninety-two, but as one thousand, right leg extended at right angles to the body; eight hundred, left leg drawn up to an acute angle with the body and bent to an acute angle at the knee; ninety, right arm from shoulder at an acute angle to the body, right forearm horizontal; and two, left arm at an acute angle to the body. Eleven would be represented by puppet ten, with the left arm extended as at puppet one.

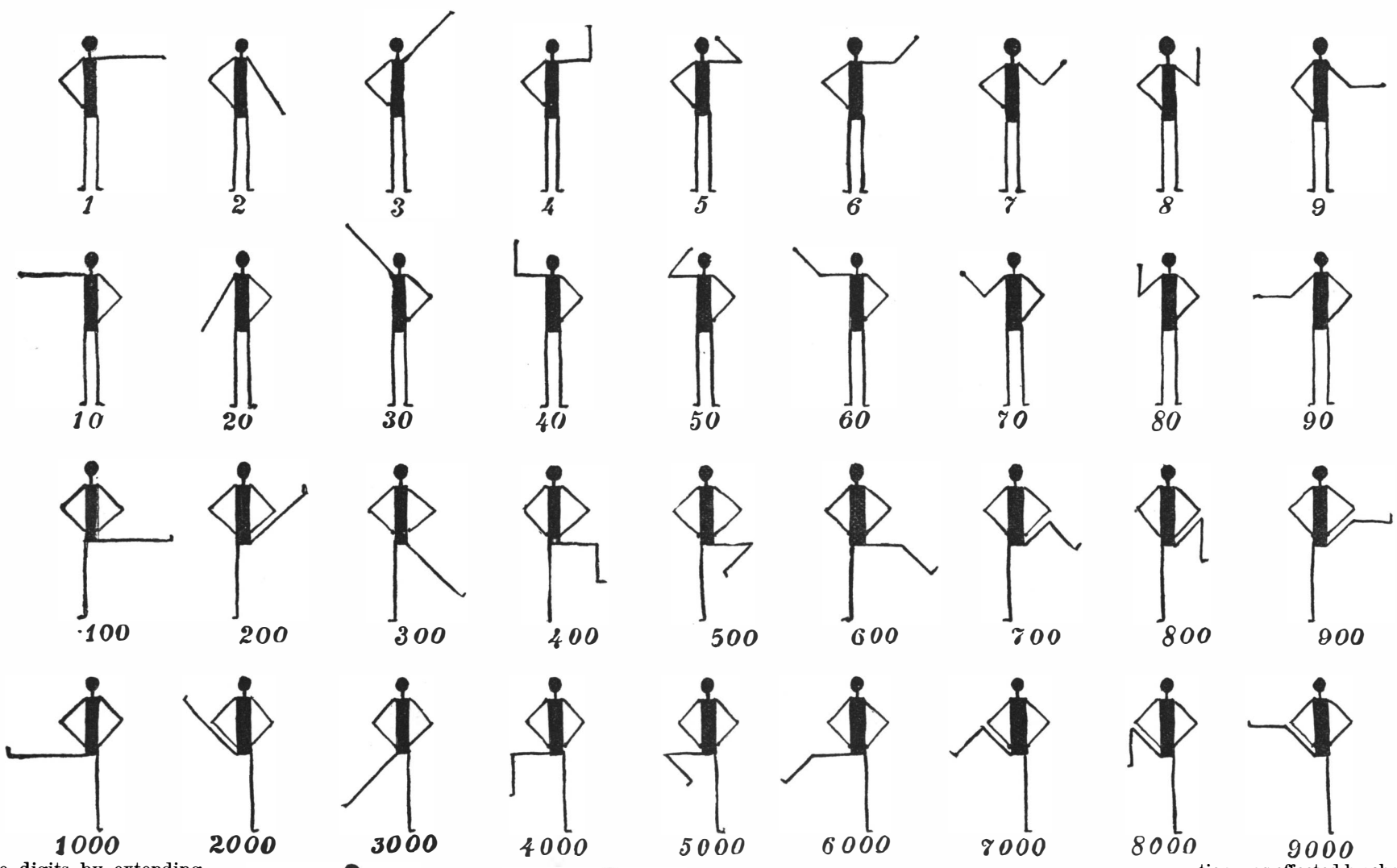


HOMOGENETIC ENUMERATION.

Twelve would be expressed by puppet ten with the left arm in the position of puppet two; thirteen by puppet ten with left arm as at puppet three; twenty-two is shown by puppet with right arm as at twenty and left arm as at two; one hundred and fifty-two with left leg as at one hundred, right arm as at fifty, and left arm as at two, etc.

A pasteboard puppet, as shown in the accompanying Fig. 2, may be made and jointed with thread. It can be worked to solve arithmetical problems, and according to certain fixed successions of movements or postures of the jointed parts may be made to add, subtract, or divide. In fact it may be taught to dance according to arithmetical measure and made to save a vast amount of ciphering, performing in this respect the use of the abacus.

You may also, if you choose to do so, make your puppet spell words. In order to do this you have only to call 1 = A, 2 = B, 3 = C, etc., until you reach the end of the alphabet, and put your figure successively into the attitudes representing the numbers that stand for the different letters forming the word you wish to spell. This whole scheme, although it has here a comical and amusing development, is a very suggestive one, and opens the question lately started in a popular scientific journal as to whether the Arabic numeration, which has for so many centuries been supposed the perfection of number expression, may not be greatly improved upon.



HOMOGENETIC ENUMERATION.

Alteration of the Great Western Railway.

For several years back the alteration of the gauge of the track of the Great Western Railway, of England, from 7 feet to 4 feet 8½ inches has been contemplated, and in the construction of new rolling stock that end was had in view. The gauges of several of the branch lines have been altered from time to time, until the remaining portion of the system not changed covered only a distance of about 200 miles. On May 19 the final arrangements were made for completing the change. Five thousand men were distributed at different points along the line before midnight, Friday in readiness for work, May 20, the intention being to have the work on the main line completed by the following Sunday at midnight, and in one day longer the branch lines and sidings completed. Throughout nearly the entire length of the line changed the alteration was effected by changing only one of the longitudinal sleepers on which the rails are laid. In some places renewals were made and at these points cross ties were used instead of the longitudinal timbers which existed in the old track. Between some points where mixed gauges existed the track will not at present be interfered with. By the use of branch lines, other roads and steamships, traffic was but slightly interfered with, and at 9 o'clock Sunday night, May 22, it was expected to run the first train over after the alteration of gauge, after which the traffic will be resumed as usual.

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The New Metal Vesbium.

With regard to the alleged discovery of a new metal, "vesbium," in the Vesuvian lava, by Prof. Scacchi, Dr. T. L. Phipson writes the following in *Iron:*

"I formerly discovered notable quantities of selenium in the arseniferous sulphur of Puzzuoli, near Naples, in 1862. I have lately examined the lava and yellow crusts of the fumarole from the crater of Vesuvius (specimens taken in 1879), and have found, besides the substances usually met with in volcanic products, considerable quantities of fluorine, which appears to have escaped the notice of Sylvestri, and minute quantities of molybdenum, which has, perhaps, given rise to the belief that a new metal, vesbium, exists in the yellow and green crusts of some ancient lava of Vesuvius, as described by the veteran observer, A. Scacchi.

"After carefully reading the paper of Professor Scacchi I am almost convinced that he was dealing with molybdenum and copper (and probably minute quantities of other substances) in the green and yellow crusts which he examined on the ancient Vesuvian lava. Nevertheless, further research is requisite. The manner in which I detected molybdenum in the yellow crusts from the fumarole found in the crater of Vesuvius in the spring of 1879 is as follows: The finely pulverized lava and its incrustation is treated with hot aqua regia; the solution, slightly evaporated and without filtering, is neutralized by ammonia in slight excess; yellow sulphide of ammonium is added, and the mixture allowed to remain for some hours in a closed vessel. It is then rapidly filtered, and the filtrate neutralized with hydrochloric acid in slight excess. The flask is closed immediately with a cork, and allowed to remain thus for two days. At the end of that time the brown sulphide of molybdenum will be found upon the precipitated sulphur. (The sulphide of molybdenum requires a long time to precipitate in an acid liquid, and more so when its quantity is small.) The precipitate is collected on a platinum dish and roasted, to drive off the sulphur and convert the sulphide into molybdic acid. Copper and lead are invariably present in small quantities in the incrustated cellular lava. The yellow crust also yields ammonia, and there are indications of many other substances to which I may refer later. I find that the lava, after being treated with a boiling solution of caustic soda, gelatinizes with hydrochloric acid, and this character may, perhaps, enable us to distinguish between the lava of modern and of ancient volcanoes."

New Method of Plating with Iron and Nickel.

Dr. Ludwig Monde recently lectured at the Royal Institution on "Metallic Carbonyls," in the course of which he dealt with the discovery made by himself and Drs. Langer and Quincke, that carbonic oxide gas will take up metallic nickel at a comparatively low temperature, and deposit it upon any surface heated to 180° C., and he exhibited tubes, globes, and other articles of bright, coherent metallic nickel, which had thus been deposited by gas. Works are in course of erection at Birmingham to carry out this curious process on a manufacturing scale.

They also discovered that at a moderate temperature carbonic oxide would take up metallic iron, and deposit it upon any surface suitably heated. Ferro-carbonyl is, however, exceedingly difficult to make. Dr. Monde exhibited some of it in a small hermetically sealed glass tube.

Ferro-carbonyl is, in a high degree, pyrophoric. It forms an amber-colored liquid, solidifies below 21° C., and distills completely at 102° C.; its specific gravity is about 1,466 at 18° C. On heating its vapor to 18° C., bright iron is deposited as a mirror. It remains perfectly unchanged in the dark, but when exposed to sunlight it is transformed into a solid body, of remarkably fine appearance, of gold color and luster.

Soon after Drs. Monde, Langer and Quincke made known the existence of this body, Sir Henry Roscoe found it in carbonic oxide gas which had stood compressed in a cylinder for a considerable time, and expressed the opinion that the red deposit which sometimes forms in ordinary steatite gas burners is due to the presence of this substance in ordinary illuminating gas. Its presence in the compressed gas used for lime lights has been noticed by Dr. Thorne, whose attention was called to the fact that this gas sometimes will not give a proper light because the incandescent lime becomes covered with oxide of iron.

A CORRESPONDENT of *Nature* gives the following interesting facts relating to the strength possessed by certain animals. The shell-less limpet pulls 1,984 times its own weight when in the air, and about double when immersed in water. Fasting fleas on an average pull 1,493 times their own dead weight, while the Mediterranean cockle *Venus verrucosa* can exert a pulling power equal to 2,071 times the weight of its own body.

So great is the power possessed by the oyster that to open it a force equal to 1319·5 times the weight of its shell-less body is required.

Electric Power now Used on World's Fair Buildings.

The engineers of the Construction Department of the World's Fair use electricity to run the machinery used in the work of construction, and have installed in the Fair grounds a perfect electrical power transmission plant—one in which the conditions are of a peculiar nature, on account of the long distances separating the apparatus and the fact that this machinery is being constantly shifted from place to place as it is required. The lines had, therefore, to be erected to satisfy any call for power from any particular spot in the grounds. The buildings of the Fair are of wood, covered with stuff which will give to them the appearance of imposing marble edifices, and the framework of the buildings is of iron. The major part of the machinery, therefore, consists of saw mills to cut the lumber, and hoists for raising into their lofty positions the immense girders, trusses and ponderous beams. In addition, there are moulding machines, planing machines, and pulverizers for the clay. The presence of the electric motors for operating the saw mills insures the absence of fire, from the danger of which the employment of steam engines is no guarantee.

The entire plant consists of the generators, the line and the motors, together with the various accessory appliances needed for the successful and economical operation of the electrical apparatus. The current of 500 volts is generated from two 100 K. W. compound-wound Edison generators, of the Edison street railway type, belted direct to two high-speed engines. The duplication of the generating apparatus was decided upon in order that the machines should be continually supplied with power, and the chances of a total breakdown obviated, one generator being capable of supplying the entire demand for a short time in case the other should be disabled. The "temporary" station in which the dynamos and engines are located is so substantially constructed that the term is almost a misnomer. The same may be said of the pole line carrying the wires and making a complete circuit of that portion of the grounds in which the motors are located. It is of first-class construction and of the best material. The high standard of insulation of the wires is always maintained, each circuit being subjected to rigid daily inspection and tests.

In the manufactures and liberal arts building—the largest structure in the Exposition, which covers an area of thirty acres—one of the saw mill plants is erected. This consists of a saw sharpener, band and cut-off saws, a rip saw and a boring machine. This compact outfit is run by a 12 K. W. Edison shunt-wound machine, belted to a line shaft. In the United States government building is another saw mill plant, run by a 15 kilowatt Edison motor. There is still another in the mines and mining building, and one in the horticultural building. In this last-named building is an electric hoist operated by a 20 K. W. Edison motor, fastened to the same frame as the base of the hoist. The hoist is of the double-drum form, with two winch heads, and can be used to raise two separate weights at once, while at the same time the winch heads can be used to drag material into position. It is now used to raise the immense trusses and purlins of the dome of this building, and has proved eminently satisfactory. In the transportation building a huge derrick has been erected for raising the trusses into position. It can be rolled to any requisite point, and has a 20 kilowatt Edison motor erected in its base frame. In this building, as well as in the agricultural building, are other electrically-operated saw mill plants.

The Exposition building, facing toward the lagoon, and ornamented on the exterior with Corinthian pilasters 42 feet high, has another saw mill plant. This building has been especially arranged with a view to electrical illumination at night, which in effect will be unequaled.

Here, too, is the large clay pulverizer, belted to a 12 K. W. Edison motor, which drives it at a speed of 1,200 revolutions a minute. In the machinery hall, the Illinois State building, the fisheries building and woman's building, are other mills and planers.

Each motor is operated by means of an ordinary starting switch and rheostat and main line switches in series with each motor. Protection is afforded by suitable fusible cutouts, and the motors are also sheltered from dust, dirt, rain and accident as far as possible. These machines are let to the contractors by the Exposition managers, the charge for their use being based upon the average daily maximum load, gauged by suitable measuring instruments. As promised by the engineers, the result of the adoption of electricity has proved entirely satisfactory, and the advocates of the portable steam engine and boiler have been compelled to acknowledge defeat. The motors have responded to every call made upon them, even to the extent of sustaining a heavy overload for a short time. The entire plant is leased from the Edison Company, and is to be returned in the same good condition as received. This transmission plant is a most important one, although only temporary, on account of its magnitude, the long distances separating the various plants, and the fact that the line is easy of access from any point within the grounds. The motors are scattered over an area a mile north and south by half a mile wide. The absolute freedom from accident or failure of any kind which the plant has enjoyed proves that this means of power transmission is as reliable as, if not more so than, any known method.

A Great Frozen Lake.

On the road from Irkutsk to Kiakhta, the frontier town of the Chinese empire, the terrible monotony of Mr. Price's journey was broken, for he had to cross Lake Baikal, the wonderful lake frozen for nine months in the year, which has sixty times the area of the Lake of Geneva, or 12,441 square miles, and has an average depth of no less than 5,404 feet, or more than a mile. Its origin, says Mr. Price, is undoubtedly volcanic. The cold is so terrible that when a hurricane stirs the waters, the waves often freeze as waves, remaining in hummocks above the surface; but when Mr. Price crossed the cold had caught the lake asleep, and the ice was perfectly smooth. He had thirty miles to drive on the solidified water: "For about a mile from the shore the ice had a thin layer of snow over it, but we gradually left this sort of dazzling white carpet, and at length reached the clear ice, when I saw around me the most wonderful and bewitching sight I ever beheld. Owing to the marvelous transparency of the water, the ice presented everywhere the appearance of polished crystal, and although undoubtedly of great thickness, was so colorless that it was like passing over space. It gave me at first quite an uncanny feeling to look over the side of the sledge down into the black abyss beneath; this feeling, however, gradually changed to one of fascination, till at last I found it positively difficult to withdraw my gaze from the awful depths, with nothing but this sheet of crystal between me and eternity. I believe that most travelers, on crossing the lake on the ice for the first time, experience the same weird and fascinating influence. About half way across I stopped to make a sketch and take some photographs. It was no easy matter, as I found on getting out of the sledge, for the ice was so slippery that in spite of my having felt snow boots on I could hardly stand. The death-like silence of the surroundings reminded me not a little of my experiences in the ice of the Kara Sea. This wonderful stillness was occasionally broken, however, by curious sounds, as though big guns were being fired at some little distance. They were caused by the cracking of the ice here and there. I was told that in some parts of the lake were huge fissures, through which the water could be seen. It is for this reason that it is always advisable to do the journey by daylight. We reached Moufshkaya, on the opposite coast, exactly four and a half hours after leaving Liestvenitz, the horses having done the whole distance of over thirty miles with only two stoppages of a few minutes each. It was evidently an easy bit of work for them, as they seemed as fresh when we drew up in the post yard as when they started in the morning."—*J. M. Price*, "*From the Arctic Ocean to the Yellow Sea.*"

A Remarkable Catalogue.

The British Museum authorities have just issued the second volume of a remarkable catalogue, says the London *Standard*. Stored in the drawers and cases of the Museum are some 50,000 inscribed pieces of terra cotta or clay tablets, forming the rescued portions of the great libraries of Assyria and Babylon. The great impetus given to cuneiform studies during the last few years in Germany and America, where they form part of the curriculum for a degree in Semitic languages, has made it necessary that the treasures of the British Museum, the center of Assyrian studies, should be catalogued, and the trustees have now issued these volumes, containing a descriptive catalogue of some 8,000 inscribed tablets. The inscriptions in question come from the Kuyuryik Mound, on the site of ancient Nineveh, which marked the ruins of the great palace and library founded by Assurbanipal, or Sardanapalus, in B. C. 650. The tablets embrace every class of literature, historical documents, hymns, prayers and educational works, such as syllabaries or spelling books and dictionaries. One of the most interesting sections is that of the omen tablets, produced by the court augurs and diviners. They saw omens in all things—the flight of birds, swallows, pigeons, the coiling of snakes, the movements of scorpions, the winds, the clouds, and, above all, the stars. The catalogues have been prepared by Dr. Carl Bezold, are beautifully arranged, and will tend to make the collections more accessible to students, and, in time, better known to the general public, who depend on specialists for the unraveling of the learning and wisdom of Chaldea.

Naval Carrier Pigeons.

The Navy Department is experimenting with homing pigeons as a means of coast communication. Birds have been placed on board the U. S. S. Constellation at Annapolis. They will be taken 100 miles to sea and be liberated at different points off the coast of Maryland and Delaware, bringing messages to the Secretary of the Navy.

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Correspondence.

Climate of San Diego.

To the Editor of the Scientific American:

On June 13 and 14, when New York City people were sweltering in a temperature of 90 to 96 degrees amid abnormal humidity records, residents of San Diego, at the southern extremity of Southern California, were enjoying life in a maximum temperature of only 65 degrees on the dates indicated, with the relative humidity at 70. The maximum July temperature here as recorded by the government is 79 degrees. Average relative humidity throughout the year is 70. Cases of sunstroke or prostration by heat are unknown, as is hydrophobia in dogs or other animals. With one of the most picturesque harbors in the world, a magnificent ocean beach, fine hotels, and attractions of the first class for pleasure and cool-air seekers, San Diego offers summer wayfarers things unobtainable anywhere in the East. M. Y. BEACH.

San Diego, Cal., June 16, 1892.

The Chloride of Silver Dry Cell Battery.

The introduction of this form of constant current electric battery for use by practitioners is in our opinion one of the most desirable advances of recent years. While the specialist may find his stationary office batteries all that need be desired, the general practitioner will welcome the invention of a battery which may be conveniently carried about either in the buggy or by hand.

The chloride of silver battery is furnished in such compact form that one of fifty cells can be easily carried in the hand.

It is claimed that this fifty-cell galvanic battery will furnish a current as strong as is needed for ordinary purposes. It is always dry and clean, having no liquid to spill over its case or over the carriage floor. Another virtue which it possesses is that it is always ready to do its work on a moment's notice, without any manipulations except the attachment of the electrodes.

Our experience with it is limited to electrolytic work upon the skin, to the treatment of neuralgias and myalgias, and to the cataphoretic application of drugs. In such service we have found the battery always ready to do its work promptly, evenly and efficiently. For the destruction of hairs, warts, etc., a current of ten or twelve cells is sufficient—provided the sponge electrodes be kept free from grease by occasionally washing them with soap and water.

In the treatment of spinal paralyses or the destruction of large tumors we have as yet not tested it.

As might be expected, the chloride of silver cell is especially well suited for the generation of the primary current of a faradic battery. Such batteries are in the market. The insertion of a metal pin sets them at once to running. The quality of work done by the faradic battery depends of course on the excellence of the coil rather than on the cell which generates the primary current.

Although the cost of these batteries is high, they do not get out of order, and the expense of refilling the cells is not great. For ordinary uses the cells will last several years without any expense in repairing or refilling.—*Maryland Medical Journal.*

A Brilliant Light.

The New York *Herald* says: Captain T. K. Bingham, United States military *attaché* at Berlin, has recently brought to the attention of the Lighthouse Board an important discovery in flash lights, the invention of Professor Schevin, of Berlin. The apparatus is only two meters high by thirty-five centimeters in diameter. On the inside is a bellows through which benzine gas is passed, while air is forced through pumice stone strongly impregnated with benzine. This benzine gas is then passed through very finely powdered magnesium and saturated therewith, thence it passes out of an upright pipe through a small flame, by which it is lighted, and here it develops a luminosity of 400,000 candles. The activity of the apparatus is regulated by clockwork.

Economy is an important feature of the new invention, but its greatest advantage is its ability to penetrate an almost opaque atmosphere to a greater extent than any other light hitherto produced. With the use of ten centigrammes of the magnesium powder it is shown by the official documents presented by Captain Bingham that a flash of 400,000 candle power can be produced, and the flash can be seen on a clear, sunshiny day at a distance of six miles. The lighthouse officials are so well impressed with the new light that they have already ordered an apparatus to be used in experiments at Staten Island.

FROM Helsingfors comes an account of an extraordinary archæological find, consisting of a chest containing a quantity of ironwork and a parchment giving a Latin treatise on steam as a force. The pieces of iron form a rudimentary steam engine, which must date from the first half of the twelfth century.

Ship Building at Newport News.

The following are some of the principal dimensions of the establishment of the Newport News Shipbuilding and Dry Dock Company at Newport News, Va.:

Ship yard contains	75 acres of land.
Frontage on the water	2,600 feet.
Buildings cover	7 acres.

DIMENSIONS OF DRY DOCK.

Length on top	600 feet.
Width on top	130 "
Width on bottom	50 "
Width at entrance	93 "
Draught of water over sill	25 "
Time required for pumping water out of dock	1 h. 30 m.

DIMENSIONS OF BUILDINGS.

Office building, 3 stories, brick	40 x 200 feet.
Pattern and joiner shop, 3 stories, brick	60 x 300 "
Machine shop, iron and brick	100 x 300 "
Boiler shop, iron and brick	100 x 300 "
Blacksmith shop, brick	100 x 300 "
Bending shed, iron and brick	60 x 127 "
Ship fitters' shop, iron and brick	60 x 320 "
Ship blacksmith shop, frame	120 x 208 "
Pipe fitters' shop, frame	50 x 208 "
Power house, brick	40 x 130 "
Lumber shed, 2 stories, frame	40 x 300 "
Pump house, brick	43 x 60 "
Paint shop, brick	50 x 160 "
Fitting-up shop, brick	50 x 175 "
Stable, 2 stories, brick	40 x 60 "
Timekeeper's house, frame	50 x 40 "

PIERS.

No. 1	60 x 900 feet.
" 2	60 x 850 "
" 3	80 x 350 "
" 4	60 x 550 "
Outfitting basin	900 x 500 "

SHIP WAYS.

No. 1	400 feet long.
" 2	400 " "
" 3	450 " "
" 4	450 " "
" 5, 6, 7, and 8, each	500 " "

The various shops are fitted with machinery of the latest pattern, and are capable of handling the largest work known in shipbuilding.

The machine and boiler shops are supplied with power-traveling cranes of 40 tons capacity, and the appliances throughout the yard for handling material are of novel design, enabling work to be done with dispatch and in an economical manner.

The Great Bridge at Memphis.

On the 12th of May last, at noon, with impressive ceremonies, the great steel bridge across the Mississippi River at Memphis was formally declared open for traffic. The *Manufacturer* gives the following description:

The crowd of visitors to the city was estimated at 30,000, including many prominent men. The wholesale business of the city made the day a holiday, and the freight departments of all railroads were closed for business, excepting for the delivery of perishable freight. The man-of war Concord, gayly bedecked from stem to stern, formed part of the procession on the river.

The bridge, with all its approaches, is about a mile and a half long. The eastern end rests upon a high bluff, the same bluff and within a few hundred yards of the identical spot, as reputed, upon which De Soto, the discoverer of the Mississippi River, centuries ago, first stood and looked down upon the mighty stream—the bluff upon which the red men in times past met in council, thus giving it the name that it still bears, the Chickasaw Bluff. From this eminence the bridge starts and stretches far across the river to the Arkansas side, where it continues on through the forest in the form of a viaduct, high above the ground, which at this point is low and swampy, and in the spring subject to overflows, which characterize much of the land contiguous to the unbridled Mississippi. There are only two truss bridges in the world having larger spans than this, the Forth and the Sukkin bridges, the latter in India. The longest trussed spans now in existence or building are these:

Forth, two spans each	1,710 feet.
Forth, two spans each	690 "
Lansdowne (Sukkin, India), one span	820 "
Memphis, one span	790 "
Memphis, one span	621 "
Colorado River (Red Rock) span	660 "

There are five spans and six piers in the Memphis bridge, including the anchorage pier. The bridge proper is exactly 2,597·12 feet long. The structure is extended west of the main bridge over the river by an iron viaduct 2,500 feet in length, followed by a 3,100 foot timber trestle and nearly a mile of embankment to a junction with the existing track of the Kansas City, Fort Scott, and Memphis Railway, a few hundred feet west of Sibley, Ark. This makes the total length of the entire structure 7,997·12 feet, or over a mile and a half. On the Tennessee side the track is finished to connect with the Kansas City, Fort Scott and Memphis Railway and the St. Louis, Iron Mountain and Southern Railway in Memphis.

The material of the main bridge is steel, largely from Pennsylvania. Some idea of the immensity of the steel parts used may be obtained by knowing that the main posts are 80 feet high and weigh 28 tons. Many of the pieces weigh 10, 12, and 16 tons. The main pin of the cantilever truss is 14 inches in diameter and weighs 2,200 pounds. The material in the superstructure weighs 9,500 tons, and one of the remarkable features of engineering skill, as well as an indication of the expertness of Pennsylvania's steel men, is that every one of the myriad of minute pieces was made in advance to fit the place for which it was intended. The Pennsylvania steel came from Pittsburg, Pencoyd, and Pottstown. Some of the steel work is unusual. One of the plates resting on the first pier from the Memphis side and coming out at the top is the largest steel plate ever made in the United States. This plate reaches from the supports under the bridge to the extreme top, and from side to side, being open through the center, and through this aperture traffic passes.

The plans of the bridge were prepared in 1888 by George S. Morrison, the engineer. The difficult work of placing the caissons in the river preparatory to sinking the pier was begun in December, 1889, and the coping of the last pier was laid on May 15, 1891. The two sides were joined and the complete chain formed between Arkansas and Tennessee on Wednesday, April 6, 1892.

The river piers are sunk to depths varying from 78 to 131 feet below high-water mark. All were sunk by the pneumatic caisson process, and are of masonry from the caissons to the bridge seat. The stone that shows above low-water mark is granite from the quarries near Atlanta, Ga. Below water and the interior of the piers is limestone from Bedford, Ind. The heights of the caissons vary from 40 to 80 feet, and the piers from 93 to 158 feet.

For the purpose of comparison the following statement regarding some of the greatest bridges of the world is given:

Location.	Material.	Character.	Total length. Feet.	Largest span. Feet.
Brooklyn, N. Y.	Steel.	Suspension.	5,989	1,595
Poughkeepsie, N. Y.	Iron.	Truss.	4,595	525
Omaha, Neb.	Iron.	Post truss.	2,750	250
Cincinnati, O.	Iron.	Suspension.	2,220	1,057
St. Louis, Mo.	Steel.	Segmental arch.	1,550	500
Pittsburg, Pa.	Iron.	Suspension.	1,245	800
Leavenworth, Kan.	Iron.	Post truss.	1,000	340
New Niagara, N. Y.	Iron.	Suspension.	....	1,229
Menai Strait, Wales.	Iron.	Tubular.	1,378	459
Montreal, Can.	Iron.	Tubular.	6,538	330
Freyburg, Switzerland.	Iron.	Suspension.	....	889
Waterloo, London.	Stone.	Elliptical arch.	....	120

The bridge is located near the spot where Ferdinand de Soto crossed the Mississippi in 1541, and in excavating for the short pier on the Tennessee side some Spanish halberds, supposed to have been used by him, were found.

To Give Flowers an Artificial Color.

William Brockbank, in the *Gardeners' Chronicle*, suggests the following for the artificial coloring of flowers: Place the cut flowers in solutions of anilin and similar dyes. Anilin scarlet, dissolved in water to about the transparency of claret, has a very rapid action on flowers, coloring them pink and scarlet. Indigo carmine produces beautiful blue tints. The two combined dye various shades of purple, with curious mottled effects, some parts of the flowers becoming pink and other parts blue and purple. Greens are produced by using the blue dye with yellow. Indigo and cochineal are not very satisfactory. Among some of the effects produced are the following: Lily of the valley flowers become beautifully tinged with pink or blue in six hours, narcissi are changed from pure white to deep scarlet in twelve hours, and delicate shades of pink are imparted to them in a very short time. Yellow daffodils are beautifully striped with dark scarlet in twelve hours, the edges of the corona also become deeply tinged, and the veining of the perianth becomes very strongly marked. It is well to note that it is by the passage of the colored solutions through the vascular tissue of the flowers that the effect is produced, and the result is beautifully seen in white tulips, which in a few hours become prettily marked with pink, blue, or whatever the color of the solution may be. So also with other familiar flowers. Forced leaves of the Swedish turnip, grown in the dark, are very susceptible to color.

Test for Bridges.

The *Centralblatt der Bauverwaltung* does not believe in the value of load tests for bridges. It considers that far too much importance is attached to it, and that, accordingly, erroneous deductions as to the safety of bridges tested by applying loads and noting the resulting deflections are abundant. The case is cited of an iron bridge in which a recent careful inspection revealed alarming local corrosion. Still, a test load, applied only a few days before, had produced a deflection well within permissible limits, and the railway company owning the bridge was therefore satisfied as to its safe condition,

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STERILIZATION OF WATER BY HEAT.

Hygienists have in all times recommended the use of boiled water when there was reason to suspect the water employed for drinking purposes. This precaution is still among those that the attention of the public is earnestly called to as soon as an epidemic of diarrhœa, cholera, etc., is threatened or develops itself. But, although so general a measure is easy to indicate to private individuals, it is more difficult of application to the population in general of a crowded locality. This is the *raison d'etre* of Messrs. Rouart, Geneste & Herscher's new apparatus for sterilizing water by heat. This ingenious apparatus furnishes the solution of a problem which has for many years occupied the attention of the Consulting Committee of Public Hygiene of France, and particularly of its eminent president, Prof. Brouardel. There is not a week passes in which the committee is not informed of the existence at some point in France of some epidemic or other, such as of typhoid fever, for which there is reason to recommend the use of boiled water to the population attacked. The same is the case in the army at every instant.

Now the French Board of Health, which possesses a most remarkable *materiel* of disinfection, has for a long time desired to add thereto some apparatus designed for the sterilization of water by heat, and which it might induce cities to procure, or which it might send to localities visited by an epidemic when the necessity therefor should be demonstrated. This project has just been put in execution, after numerous tentatives, by Messrs. Rouart, Geneste & Herscher, in the following way: The drinking water is led into a pump, whence it is sent to the lower part of a metallic cylinder containing a worm. When this cylinder is filled, the water reaches the bottom of a second cylinder constructed in the same way, and then it is finally led to a receiver, in which it is heated to 120° under pressure, in contact with steam pipes connected with a boiler (Fig. 1). After the water has boiled for a certain length of time it is forced into the worms of the two cylinders designed for the reception, in the first, of the pure water; then, after cooling, and a subsequent filtration through a layer of silicious sand, it flows outside.

The boiled water must be promptly consumed, for, like all pure water, it possesses the singular power of becoming rapidly, but temporarily, self-infected. Whatever may have been said of it, it is easily digestible after it has been sufficiently aerated. It would be well, then, to obtain it in sufficient quantity, at least, for drinking purposes.

Fig. 2 gives a diagram of this ingenious apparatus, which comprises, essentially: A boiler with an independent steam reservoir, one or more exchangers, and a filter. The exchangers, which are cylinders provided with worms, constitute the most interesting and original part. The impure cold water that they receive is heated by the temperature of the boiled water circulating in the return worms, and this same boiled water becomes cooled therein by giving up its heat to the water which goes to the boiler. In this way the exchange of temperature is effected without expense, and it is possible to easily furnish, on its exit from the apparatus, water sufficiently cool to be used at once.

In fact, experience has proved that water that has been submitted in this apparatus, for at least fifteen minutes, to a minimum temperature of 120° may make its exit therefrom with a temperature but 2° higher than that which it had when it entered. As for the micro-organisms that it contained, there no longer remain any trace of them. It is absolutely sterilized. The statements of Messrs. Miquel, Pouchet & Charrin are very precise and demonstrative on this point. It remains to be known how such an apparatus can be put in use. Messrs. Rouart, Geneste & Herscher have devised several arrangements to this effect. In one, it is by the aid of a hand pump that the water is introduced; in another, much larger, a pump fed by the boiler allows the impure water to circulate in the various parts.

These different models are mounted upon wheels, so that they can be moved about and installed *in situ* in communities visited by epidemics. Fig. 1 represents an installation of this kind upon a village square, whither the inhabitants are coming to fill their pails and pitchers with water that has been sterilized by boiling, that is exempt from germs, and that is without a disagreeable taste. They obtain the water from a tube, whose extremity they lift up, so as not to soil it.

The low net cost of water thus boiled favors the application of this industrial process, which has already rendered signal services in the barracks of the marine at Brest, where typhoid fever prevailed for many years almost in an epidemic state.—*La Nature.*

Fig. 1.—APPARATUS FOR STERILIZING WATER BY HEAT.

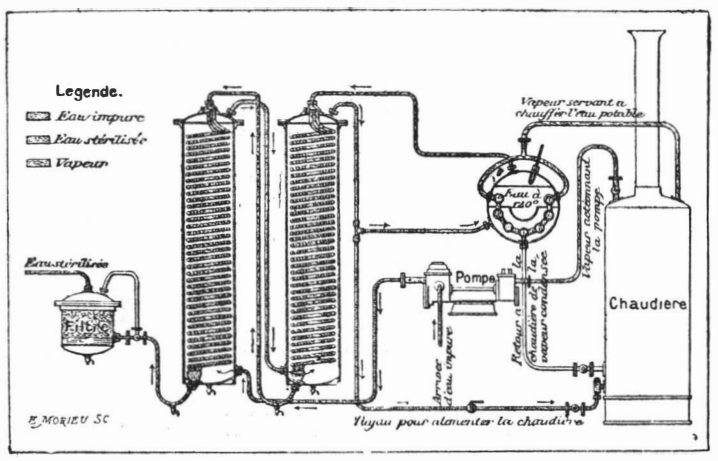

Fig. 2.—DIAGRAM OF THE APPARATUS.

Good and Simple Plumbing Idea.

One of the finest object lessons in sanitary plumbing in the United States is, according to the Philadelphia *Ledger*, the new Institute of Hygiene at the University of Pennsylvania. Throughout the building the pipes have been left outside the walls, and each painted a distinctive color. Thus a maroon pipe, wherever found, is a steam pipe, red always denotes hot water, blue stands for cold water, white means gas, and yellow shows drainage. This makes it possible to trace each system in all its branches, and test it at will, from the cellar to the roof. About everything in the way of drainage devices now known is in the building, and anything put on the market will be given a fair trial.

Cleaning Castings.

Two methods of cleaning iron castings are in general use. One, which is applicable to small castings, consists in treating the pieces in a tumbling barrel, the knocking of the castings together serving to dislodge the sand attached to the casting, but the objection to this method is that the treatment which removes the sand also defaces the castings, by removing the finer features and destroying the corners. The other method of cleaning castings consists in placing them for several hours in a pickle or acid bath (a mixture of one part of sulphuric acid to ten or twelve of water); the acid attacks the surface of the iron and releases the scale.

The sand blast has been suggested as a substitute for this latter method. It is said that it will readily remove the sand spots, leaving the castings in good condition. It would seem, however, that unless the bare portions of the casting are protected, the sand blast would attack the iron as readily as the scale. As it is obviously impracticable to protect the bare surfaces of the iron, it would seem that the sand blast method has very little of practical value.

Lathe Testing.

The method of lathe testing, which consists in bringing the centers of the lathe together and sighting them, is of no value for even ordinary machine work. If the centers could be adjusted exactly in line by this method, when they are separated they may be found incorrect for any other distance.

It is practically impossible to turn a true cylinder between the centers of any lathe, however perfect; true cylinders can be produced by grinding only, the work being supported upon the centers.

The first operation in testing a lathe is to put the centers in line at a distance of from two to ten feet, according to the size of the lathe. Place in the lathe a piece of shafting, stiff enough to support itself without springing; square up its ends, and center it, taking care to have the centers drilled deep enough to prevent the lathe centers from bottoming. Insert a pin in the end of the shaft, so that it can be driven without the use of the lathe dog. With a sharp tool turn the head end of the shaft for a short distance. Then, without moving the tool, take the work out of the lathe, run the tool carriage down to the tail stock, replace the work, and turn the opposite end of the shaft for a short distance. If the calipers show no variation in the size of the work at opposite ends of the shaft, the lathe is in line; if there is a difference, the tail stock must be set over until the tool, without further adjustment, turns the same diameter as it did at the opposite end of the lathe. In making this test the tool should be set exactly level with the centers.

With the lathe adjusted to this extent, remove the turning tool and insert another having a very fine point. Run the carriage back, remove the live center, replace it with a stick three feet long fitted to the spindle and firmly driven in the place of the center, run the carriage up and allow the fine-pointed tool to scratch the end of the stick as it revolves; if it makes a point, the lathe is true. If the tool describes a small circle, the lathe is out of true, and the headstock must be readjusted by scraping the surfaces which bear upon the bed, to make the necessary correction. Remove the tool and run out the tail spindle; if the dead center goes into the point made by the tool, the lathe is true. If the center does not enter the point, the tailstock must be corrected by scraping, as in the case of the headstock. This method of testing is open to the objection that the stick may spring of its own weight. Lathe builders have special apparatus for this purpose, consisting of rigid metal bars or light rods stiffly trussed.

Dr. Brown-Sequard's Treatment.

At a recent meeting of the Academy of Sciences, Paris, much interest was created by Dr. Brown-Sequard's paper on his system of treatment with injections of a solution of sperm fluid. The *savant's* address bristled with proofs of its efficacy. He instanced a patient of 80, living at Mauritius, who was restored from a paralytic and atonic state to health and vigor. Another somewhat younger man, bed-ridden, and regarded as moribund, was re-established sufficiently in a fortnight to take severe horse exercise, "and now," drily added the doctor, "his health improves so rapidly that the family have forbidden the medical man to continue the treatment." Dr. Brown-Sequard claims that the 20,000 injections made by him during the last three years have been invariably successful, and that the system is without equal in cases of weakness and debility. He specially touched on the treatment of tuberculosis and locomotor ataxy. The physical improvement, far from reacting on the patient's spirits, invigorates the mind at the same time as the body. This remark, coupled with the eminent doctor's exhaustive discourse, and his fresh and vigorous appearance, created a whisper in the assembly that Dr. Brown-Sequard had himself laid the guinea pigs under contribution, although he did not mention the fact in his discourse.

A SODA water fountain which works on the nickel in the slot plan has been invented; the customer helps himself, but cannot get more than 5 cents worth at a time.

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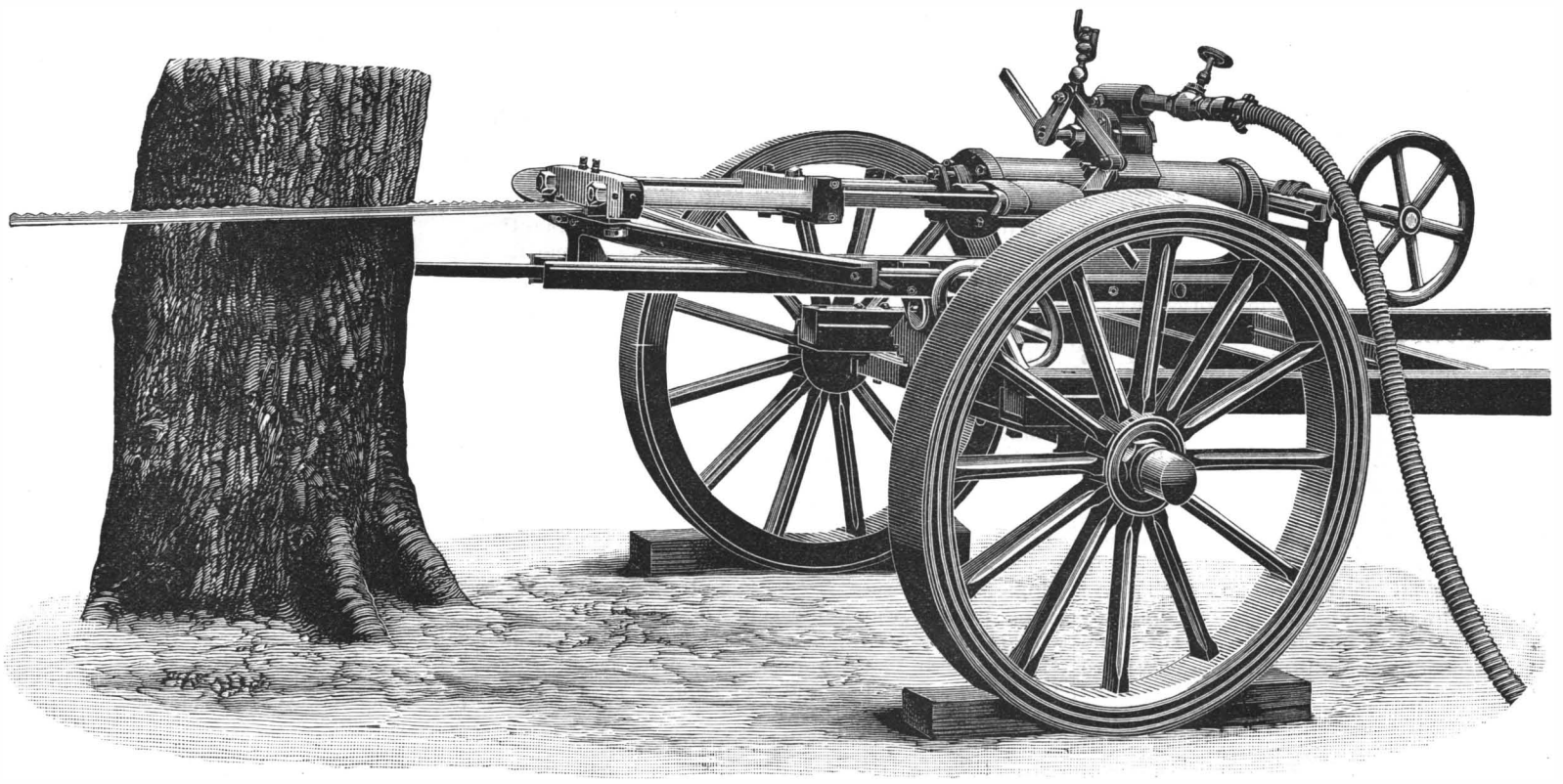
STEAM TREE-FELLING AND CROSS-CUTTING MACHINERY.

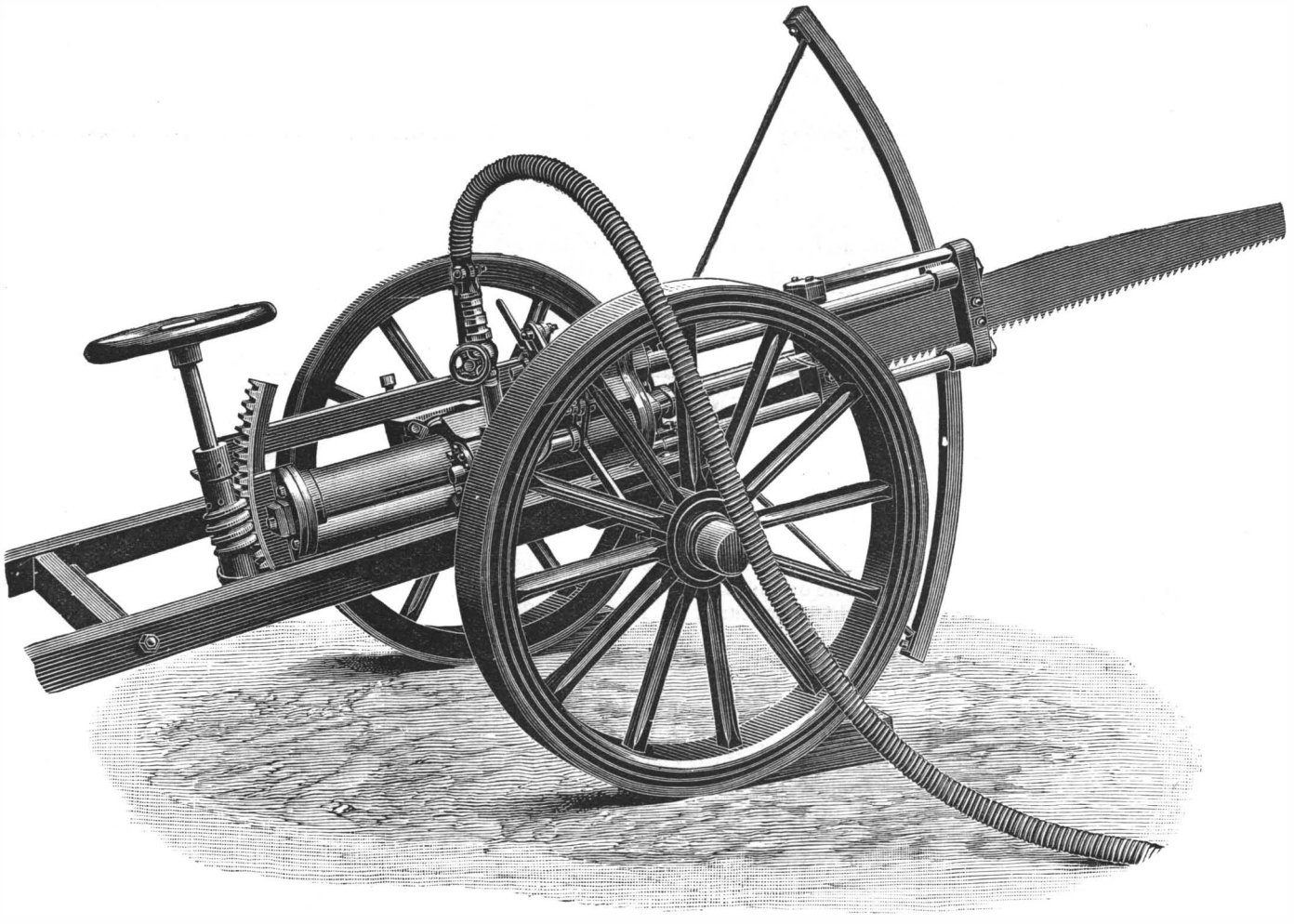
This arrangement of mechanism, by Mr. Allen Ransome, of London, was recently illustrated in *Engineering*, to which we are indebted for our engravings and the following particulars:

The machines have a long stroke, which obviates the difficulty of the teeth clogging, and are mounted upon a strong axle, supported on a pair of wheels of such a diameter as to enable the saw to cut through a tree at a height of about three feet from the ground. This skeleton carriage is fitted with a pair of shafts, to which a horse can be harnessed for transporting the machine in the forest, and which also facilitates the movement of the saw from tree to tree by hand.

The entire machine can be partially rotated on its axis, so that, by simply turning a hand wheel, the saw can be set to cut in a vertical direction, or at any angle between the horizontal and vertical positions. It generally happens that when a large tree falls it does not lie flat, as its branches hold the upper part of the trunk off the ground, and so, in order to cross-cut trees lying in such positions square, it is necessary to incline the saw somewhat from a direct vertical line, which is readily done by the adjustment last described. Again, in order to cross cut through a high-lying trunk, it is necessary to elevate the saw, or, on the other hand, in the case of a low-lying log, to depress it. To effect this, slotted stays are attached to each shaft, the lower ends of the stays being pivoted to short stakes driven into the ground. A strong bolt passing through each shaft takes into the slot in each stay, to which it can be instantly set fast by means of a nut furnished with a handle, and thus, by raising or depressing the shafts, the saw can be set at the required elevation to suit logs lying in any position.

The above-described improvements render the machine not only much more convenient to work and adjust, but suit it for dealing with trees of very large sizes. When found desirable to fell a tree close to the ground, the machine can be readily detached from its carriage and the frame laid on the ground. Another improvement relates to steam cross-cut saws, which are fixed at the entrance of the mill for cross-cutting logs as they are being brought in to any required lengths. When a heavy log is being dragged into the mill, it is extremely difficult to arrest its progress exactly in the position required in front of the saw, while to shift it endwise even a few inches by hand is a work of considerable labor and time. To obviate this, Mr. Ransome's saw is mounted upon a short bed or gantry, the upper surface of which is level with the floor. This bed, fixed in a position parallel to the log, is provided with a powerful square thread screw, which passes through a nut attached to the under side of the machine. At one end of the screw is a large hand wheel, overhanging the gantry, and thus, by turning this wheel, the saw blade can be readily brought opposite to the exact spot at which it is desired to cross-cut the log.





IMPROVED STEAM TREE-SAWING MACHINE.

Edible Chrysanthemums.

Chrysanthemums, those handsome autumn flowers that are so highly esteemed by us for their beauty, are valued in Japan for an entirely different reason. The Japanese, in fact, do not raise chrysanthemums as ornamental plants, but cultivate them as edible ones. It is the flowers that are employed by amateurs. Those are eaten as a salad after being steeped in water and then boiled.

In Japan, the flowers of the chrysanthemums constitute a truly popular dish, and during the months of November and December bunches of them, washed and carefully displayed, may be seen in the stores of all the dealers in vegetables. Almost all the varieties are edible, strictly speaking, but those to which preference is usually given are the ones with small deep yellow flower heads, and which are not so pretty as the varieties cultivated for ornament.

Tempering Springs by Electricity.

Electricity as an aid to gun making is, it is said, in successful use at the gun factory of St. Etienne. The particular use to which it is there put is in the tempering of springs. These consist of steel wire wound spirally, and a current of 23 amperes at 45 volts is passed through. Rapid heating results, and when the required temperature has been reached, the current is broken and the spring falls into a trough of water. One workman can temper 2,400 springs per day by this method.

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Natural History Notes.

Albino Animals in Old Mines.—In connection with the recent resumption of mining along the famous "blue lead," near Bangor, Cal., a most peculiar discovery was made. Among the mines now being worked is the old Potter mine, which has been rechristened the Bishop mine, after its present owner. When this mine was first reopened, a young man entered a dry slope leading to a second shaft, the existence of which was unknown, owing to a thick growth of brush and trees about it, and had nearly reached the shaft when he noticed a large number of flies buzzing about him in a very troublesome manner. He made several slaps at them, and accidentally caught one. On examining it by the aid of his lantern he was nearly startled into letting it escape by reason of its uncanny appearance. It was absolutely white, with the exception of its eyes, which were red and unusually large and prominent. Scarcely had the explorer recovered from his surprise at the white flies, when he was startled by the whirring sound of a rattlesnake's tail. Looking carefully around, he saw the eyes of the reptile, and threw a rock in the direction of them. The rattling promptly ceased, and a mass of white, glistening convolutions writhed into view from behind a protruding bowlder. A couple more rocks dispatched the reptile, which proved to be a rattler over four feet in length. One of the rocks thrown had detached a good part of the snake's rattles, so its age could not be ascertained, but it must have been an old individual. The color of the snake was pure white.

Prof. Harlow Ballard, of Buffalo, N. Y., who was visiting Bangor in search of mineral specimens, secured the snake and several specimens of the white flies, which he preserved and shipped to the East. The professor is of the opinion that the flies are the offspring of some imprisoned in the slope years ago by the rising of the water in the lower workings. The old and partially filled shaft allowed air but no light to enter the slope, while the stream flowing into the slope may have provided them with food.

The snake, he thinks, may have been carried down by the water while very young, as it is scarcely possible that it is thirty years old, which it would have been had it remained there ever since the mine was flooded. What the reptile ate during its long captivity is among the mysteries. Since the reopening of the Bishop mine the white flies have entirely disappeared, and a few which Prof. Ballard kept in a small glass case resumed the colors of ordinary house flies within a week after exposure to the light.

The Longevity of Birds.—Ornithologists have not yet definitely solved the question as to whether birds are not, of all animals, those that have relatively the longest existence. The following are a few examples of the longevity of birds, borrowed from the *Revue de l'Art Veterinaire*, published in Russia: It is established that swans live to be three hundred years old. Knauer, in his *Naturhistoriker*, claims to have seen a large number of falcons a hundred and fifty years of age. Eagles and kites likewise live for a long time. Knauer tells of the death, in 1819, at Berlin, of a sea eagle that had been captured in 1715, that is to say, a hundred and four years previously, and which was then already some years of age. A white-headed kite, taken in Austria in 1706, died in the poultry yard of the palace of Schonbrunn, near Vienna, in 1824, after passing a hundred and eighteen years in captivity. Sea and marsh birds survive several human generations. Ducks and cuckoos are likewise very long-lived. It is claimed that ravens often reach the age of a hundred years. Magpies, which live to a very advanced age at liberty, do not exceed twenty-five years in the confinement of a cage. It is not rare to see domestic cocks of fifteen years, and with care they reach twenty. The limit of the existence of pigeons is ten years; the smallest species live from eight to eighteen years. Nightingales will not endure more than ten years of captivity. Canaries reared in a cage live twelve or fifteen years, but in their native islands they reach an age of several dozens of years.

Ants and Mites.—The curious habit which ants have of harboring in their nests a variety of other insects is a well known fact. The reason for this singular exercise of hospitality is by no means always apparent; in some cases, however, it does appear to be fairly clear, particularly in the case of certain mites (Gamasids), whose habits and customs are treated of by Mr. A. D. Michael in the recently published part of the *Proceedings* of the Zoological Society of London. The author of this paper investigated a number of ants' nests in Corsica and in the neighborhood of Innsbruck, and in many of these nests there occurred various species of Gamasids, whose relation to their host formed the subject of the inquiry dealt with in the paper. The nests of a small yellow ant, *Tetramorium cæspitosum* var. *meridionale*, were infested with two kinds of Gamasids. One species, which Mr. Michael describes as new, under the name of *Lælaps equitans*, was not only found in the nests, but also upon the ants themselves; and, when the nests were disturbed, the mites, being slow of foot, leaped on to the head of a passing ant, and were borne off to a place of safety. The ants appeared to have not the slightest objection to this familiarity on the part of their guests; on the contrary, indeed, for they carried off the mites without making the least attempt to dislodge their riders, and ants are not as a rule the most peacefully disposed of animals. In the case of another species of ant, the care taken of the Gamasids was even more remarkable. When danger threatened the colony, the ants carried off both the mites and their young, just as they carry off their own young. After a careful series of experiments, Mr. Michael comes to the conclusion that the mites repay the hospitality shown to them by removing the bodies of deceased ants, which they utilize as food.

The Galls of Tree Leaves.—Mr. Laboulbene, as the result of his researches on the cause of the production of galls upon the leaves of trees, finds that these singular excrescences are not capable of being produced by the action of stings, incisions, or the introduction of drops of formic or other acids, nor through the effect of the presence of foreign bodies, or even of the eggs of non-galligenous insects. On the contrary, he has been able to establish the fact that galls develop when certain insects called *galligens* deposit their eggs upon the leaf. There exist two causes of production; one, and the principal of which, is the result of the vesicatory action of a liquid emitted by a special gland, and the other the vivification of bacteria analogous to those cultivated by Mr. Pasteur.

Wingless Female Lepidoptera.—Mr. G. A. Poujade, in *La Nature* for December 26, 1891, gives an admirable summary of the natural history of the European species of Lepidoptera without wings, in the course of a series of articles upon the influence of artificial light upon insects. He calls attention to a most interesting observation by Giraud, made as far back as 1865, and which has seldom been repeated, to the effect that the wingless females of *Hibernia* and *Cheimatobia* were found around the lanterns in the Bois de Boulogne, where they were supposed to have been either attracted by the light or the abundance of male insects which had been so attracted, and had climbed up the lamp-posts and had taken their position upon the glass sides of the lamp. The more natural explanation seems to us that these females had been carried by light-attracted males while in the act of copulation and had been deserted on the glass side of the lamps. It would be very interesting to know whether similar observations have ever been made in this country in districts where the canker worm is abundant.—*Insect Life.*

History of the Discovery of the Sexuality of Plants.—At one of the last sessions of the Society of Botanists of Brandebourg, Mr. F. Moewes recalled the fact that the knowledge of the sexuality of plants had recently seen its bicentenary jubilee.

In fact, it is two hundred years ago that the physician and botanist, Rod. Jak. Camerarius, professor at Tubingen, separated two female types of the French mercury (*Mercurialis annua*, L.) from a group of plants of the same nature growing in a garden, and remarked that they presented hollow seeds only. His report upon the subject, published in the ephemerides of the Leopoldine Academy, bears the date of December 28, 1691. This was the first experimental research by which Camerarius demonstrated that plants are reproduced, like animals, by means of sexual organs. Until then, only confused notions existed upon the subject. No one had thought of submitting the question to the test of experiment. Camerarius recognized that the stamens constituted the male organs and the pistil the female organ. This is shown by the title of his memoir, which appeared in 1794: "De Sexu Plantarum Epistola."

A hundred years after Camerarius' remarkable discovery, there appeared a book treating of this same sexuality in plants, upon which it threw a new and brilliant light. Like its senior, it was not appreciated by the scientists of the epoch. Although Camerarius had, from 1691 to 1698, shown the necessity of the intervention of pollen in the act of fecundation of plants and of the production of the seed, or, to employ an expression of Goethe, that plants abandon themselves in the bosom of the flower to the sports of love, the special destination of the various parts of the plant remained always an enigma. Yet flowers, with their peculiar properties, their wealth of bright colors derived visibly from the green of the leaves, the surprising variety of their forms, and the odors with which they perfume the air, must have especially attracted the attention of the learned world. It was not till 1793 (it will, therefore, soon be a century) that a schoolmaster, Regent Christian Conrad Sprengel, of Spandau, rent this veil in his turn by demonstrating with a rare penetration, truly bordering on genius, the functional role of the organs of the flower, and principally of the party-colored petals.

The facts brought to light by him, and which now form part of the uncontested patrimony of science, appeared to him so surprising that he entitled his book, "The Mystery of Nature Unveiled in the Framework and Fecundation of Plants." The discovery of Sprengel, who, let us say by the way, recommended the botanists of his time to study plants *in vivo*, in the very midst of nature, instead of being content with an examination, in the closet, of dead and withered specimens contained in a herbarium, was of so high importance for the scientific explanation of the function of the various floral organs that it is hard to explain how Sprengel's work, still so remarkable to-day and always so interesting to study, could have passed so completely unnoticed. However incredible it may appear, it is none the less true that this genial book remained completely ignored until 1862, when it was brought to light again by Darwin, who was then occupied with the question, and whose genius was to develop so powerfully this field of investigation.

The Treatment and Feed for Sick Horses.

F. T. McMahon, veterinary surgeon to the Chicago City Railway Company, the Chicago Fire Department, etc., communicates to the *Street Railway Review* a lengthy article on the treatment of sick horses, from which we copy. The principal substances from which we select articles of diet for the sick horse, says the writer, are bran, carrots, oatmeal, linseed, etc.

Bran stands decidedly foremost as the food most generally in use for the invalid horse; it acts as a laxative; is frequently tempting to the appetite, and is easy of digestion. There is no part of general treatment more universal than offering this substance as a change of food. Is the horse very weary, and his powers of digestion weakened in consequence, we induce him to take a warm bran mash, which comfortably distends the stomach, and satisfies any craving for food, thereby enabling him readily to lie down and rest his enfeebled system, until repose restores its wonted vigor. Does he show slight symptoms of cold or fever, a warm bran mash is a convenient plan of steaming, and consequently soothing, the irritable mucous membranes of the air passages; it is a substitute for the more stimulating diet he is accustomed to, and gently promotes the activity of the digestive apparatus; it is also a convenient medium for the exhibition of certain simple remedies, to be mentioned hereafter. Is he incapacitated by lameness, a lower diet than that with which he is indulged when in full work is judicious, and bran is selected. Is it necessary to administer purgative medicine, a bran mash or two renders the bowels more susceptible of its action, and a smaller portion of the drug is therefore required to produce the desired effect, there being, at the same time, less risk of painful spasms accompanying its operation. Bran mashes may be given hot or cold—cold are perhaps quite as grateful to the horse; but the nibbling of the hot mash in catarrhal affections is particularly beneficial, from the necessary inhalation of the steam arising therefrom.

Of all the roots by which horses are tempted, the carrot, as a rule, is the favorite, and perhaps the most beneficial one. It is said to be somewhat diuretic in its effect, and to exercise a salubrious influence on the skin. Certain it is, when cut and offered frequently by the hand of the groom, a sick horse is coaxed into eating it when disinclined to partake of other nourishment, and the greatest benefit results. For the ailing horse, then, carrots are most valuable as an article of diet, and a few may be given with advantage even to the horse in healthy condition.

Oatmeal is most nutritious, and, as a food for the convalescent horse, is most valuable; the bruising process the grain has undergone breaks the husk, and renders it more easily acted upon by the digestive powers. It is usually given in the form of a gruel, as which it is one of the most essential articles of diet for the infirmary. It is also a ready mode of supplying the tired, thirsty horse with nourishment after exertion, when he returns to the stable.

Linseed is decidedly included in the sick diet roll. It is nutritious, and from its oleaginous nature, soothing to the frequently irritable mucous membrane of the alimentary canal, and hence to be particularly recommended in the treatment of sore throats; nor is its bland effect local only, its more general influence is particularly observable in affections of the kidneys. It may be given either boiled, forming, when cool, a gelatinous mass, mixed in that state with bran, or the liquid after boiling may be offered as a drink.

Grass, hay tea, etc., are also very useful in the treatment of disease, and should be used in connection with the other remedies.

Professor Cooke's Saltpeter Remedy.

Dissolve one tablespoonful of saltpeter in a pail of water. A pint poured around each hill of cucumbers or squashes is very good for the plants and very bad for the bugs, both striped and black, which burrow at night in the earth about the plants. Cut worms are also said to dissolve like earth treated with saltpeter. This is a remedy which would certainly be very useful to the plants, and if, as is claimed, it destroys or keeps away insect marauders, it will prove most valuable. This saltpeter solution is useful to any plant which is attacked by insects which at any time burrow in the ground. It does not appear to be wholly certain, however, that it is as efficacious an insecticide as could be wished.

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Oxygen and Pure Water for Health.

In a lecture on the advantages of vegetarianism in malarial climates, by Doctor J. H. Kellogg, he speaks of the necessity of an abundance of oxygen and pure water to insure good health.

There are no purifying agents for the blood like pure air and pure water. Oxygen is a general house cleaner, it saturates the blood, and thus reaches every part of the system, while water is just as good and necessary for cleansing the tissues on the inside of the body as it is for keeping the outside of the body clean. The notion that many people have of purifying the blood by putting something into it is absurd—as though impure substances could have any purifying effect. Would soiled clothing be much improved by being washed in a decoction of burdock root or sarsaparilla? Let one with blue lips and pallid face start out briskly for a run, and in a short time he comes in with rosy lips, bright eyes and an altogether different countenance. The oxygen which he has been taking in has served to wash out the effete matter and burn it up, and he is a new man. Then take plenty of exercise in the open air, live in well-ventilated rooms, eat simple, wholesome food, and drink freely of pure water, and you will need no other blood purifier.

REMARKABLE EXPERIMENTS WITH LIQUEFIED AIR AND LIQUEFIED OXYGEN AND OTHER LIQUEFIED GASES.

Professor Dewar recently delivered a lecture at the Royal Institution dealing with the above subject, in the presence of a large auditory, with Lord Kelvin, president of the Royal Society, in the chair. We follow the report given in the *Engineer*.

Professor Dewar began by thanking those who had presented the Royal Institution with the machinery and appliances which would enable him to show the experiments of that evening, and at that early stage of the proceedings he felt bound to thank his two assistants, Mr. R. N. Lenox and Mr. J. W. Heath, for their arduous work for some time past in preparing for the demonstrations of that evening, in the course of which he should use up a hundredweight of liquid ethylene, which had been weeks in manufacture from alcohol and strong sulphuric acid, and compressed in the laboratory. He was thus enabled to go farther than in his lecture at the Faraday Centenary. The apparatus before them in the theater was supplied by means of pipes from the laboratory with liquid ethylene and with liquid nitrous oxide; the latter was used to cool the apparatus in the first instance.

He first filled a test tube with liquid oxygen, of which he said that he should probably use a pint in the course of the evening. They would notice that it was not clear, but looked milky, from the presence of some impurity, of which impurity he would say no more, as he did not know its cause. He would, however, pass the liquid through filtering paper as one would filter water, and they could see that it came through quite clear; on throwing an image of the test tube and its contents upon the screen, the liquid oxygen was seen to be of a cold pale blue color. It was boiling violently at the temperature of the air, with a hissing noise, and giving off clouds of, apparently, white smoke, due to the freezing of the moisture in the adjacent air of the theater. Liquid oxygen boils at —180° below the zero of the Centigrade scale, as determined by thermo-electrical measurements.

Here a liter of liquid oxygen was placed in a flask, and deposited on the lecture table, from which flask Professor Dewar took some now and then, when required in the experiments. He then drew attention to the following table:

Boiling Points—Below the Freezing Point of Water.

	Boiling point Below F. P. of W.	Boiling point. At 5 to 10 mm. pres.
Carbonic acid	— 80 deg. C.	— 116 deg C.
Nitrous oxide	— 90	— 125
Ethylene	— 103	— 142
Oxygen	— 184	— 211
Nitrogen	— 198·1	— 225 solid.
Air	— 192·2	— 207 solid.
Carbonic oxide	— 193	— 211
Nitric oxide	— 153	— 176
Marsh gas	— 164	— 201 solid.

Professor Dewar next showed that liquid oxygen is a non-conductor of electricity, and that a spark one-tenth of a millimeter long, from a coil machine which would give a long spark in air, would not pass through the liquid. It gave a flash now and then, when a bubble of the oxygen vapor in the boiling liquid came between the terminals. Thus liquid oxygen is a high insulator.

As to its absorption spectrum, the lines A and B of the solar spectrum are due to oxygen, and he showed that they came out strongly when the liquid was interposed in the path of the rays from the electric lamp. Dr. Janssen had recently been making prolonged and careful experiments on Mont Blanc, and he found that these oxygen lines disappeared more and more from the solar spectrum as he reached higher altitudes. The lines at all elevations come out more strongly when the sun is low, because the rays then have to traverse greater thicknesses of the earth's atmosphere.

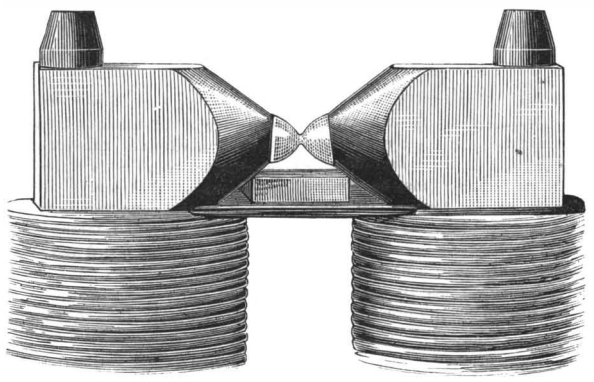
Here Professor Dewar, by means of liquid oxygen, and its evaporation accelerated by a high exhaustion pump, liquefied some common air in an open test tube, at the ordinary pressure of the atmosphere. It came down clearer and "smoked" less than did the liquid oxygen; it also boiled more quietly. This liquefying of common air, he said, is useful, as by its evaporation they would be able to get lower temperatures in the future than had hitherto been reached.

He then spoke of Michael Faraday's experiments in 1849 on the action of a magnet on gases placed between its poles, and in subsequent experiments he employed the magnet, now historical, which had been used by Faraday. He also drew attention to the following table, in which + means "magnetic," and — means "negative."

Magnetic Relations of Gases—Faraday.

	In Air.	In Carbonic Acid.	In Hydrogen.	In Coal Gas.
Air	0	+	+ weak	+
Nitrogen	—	—	— strong	—
Oxygen	+	+	+ strong	+ strong
Carbonic acid	—	0	—	— weak
Carbonic oxide	—	—	—	— weak
Nitric oxide	— weak	+	+	
Ethylene	—	—	—	— weak
Ammonia	—	—	—	
Hydrochloric acid	—	—	— weak	

Professor Dewar stated that Becquerel was before Faraday in experimenting upon this subject. Becquerel allowed charcoal to absorb gases, and then examined the properties of each gas. He thus discovered the magnetic properties of oxygen to be



MAGNETIC ATTRACTION OF LIQUID OXYGEN.

strong, even in relation to a solution of ferrous chloride, as set forth in the following table:

Specific Magnetism, Equal Weights—Becquerel.

Iron	+	1,000,000
Oxygen	+	377
Ferrous chloride solu. sp. gr. 1·4334	+	140
Air	+	88
Water	—	3

Professor Dewar then took a cup made of rock salt, and put in it some liquid oxygen, for the liquid does not touch rock salt, but remains in it in a spheroidal state. The cup and its contents were placed between and a little below the poles of the magnet. Whenever the circuit was completed, the liquid oxygen rose from the cup and connected the two poles, as represented in the cut, which is copied from a photograph of the phenomenon. Then it boiled away, sometimes more on one pole than the other, and when the circuit was broken it fell off the pole in drops back into the cup. He also showed that the pole of the magnet would draw up liquid oxygen out of a tube. The magnetic property of liquid oxygen, he said, is about 1,000 as compared with 1,000,000, the magnetic power of iron. The cooling of a body, he added, increased its magnetic power. Thus, cotton wool, cooled by liquid oxygen, was strongly attracted by the magnet, and a crystal of ferrous sulphate, similarly cooled, stuck to one of the poles of the magnet.

The lecturer remarked that fluorine is so much like oxygen in its properties that he ventured to predict that it will turn out to be a magnetic gas.

Common air, he stated, liquefies at a much lower temperature than does oxygen, and one would expect the oxygen to come down before the nitrogen, as stated in some text books, but unfortunately it is not true. They liquefy together. In evaporating, however, the nitrogen boils off before the oxygen. Here he poured two or three ounces of liquid air into a large test tube, and a smouldering splinter of wood dipped into the mouth of the tube was not re-ignited; the bulk of the nitrogen was nearly five minutes in boiling off, after which a smouldering splinter dipped into the mouth of the test tube burst into flame.

Professor Dewar then poured out a wineglassful of liquefied common air, and presented it to the chairman, cautioning him to hold the glass only by the lower portion of the stem.

Between the poles of the magnet, all the liquefied air went to the poles; there was no separation of the oxygen and nitrogen. Liquid air has the same high insulating power as liquid oxygen. The lecturer remarked that the phenomena presented by liquefied gases present an unlimited field for investigation by many workers. At such low temperatures they seemed to be drawing near what might be called "the death of matter;" liquid oxygen, for instance, had no action upon a piece of phosphorus dropped into it; and once he thought, and publicly stated, that at such temperatures all chemical action ceased. That statement he now withdrew, for he had found that a photographic plate standing in liquid oxygen could be acted upon by energy coming from outside, and at a temperature of —200° C. was sensitive to light.

His friend, Mr. McKendrick, had tried the effect of these low temperatures upon the spores of microbe organisms, by submitting putrefied blood, milk, and such like substances for one hour to a temperature of — 182° C.; they afterward went on putrefying. Seeds, also, withstood the action of a similar amount of cold. He thought, therefore, that the experiments had proved that the idea of Lord Kelvin uttered some years ago was possibly true, when he suggested that the first life might have been brought to the newly cooled earth upon a seed-bearing meteorite. He lastly drew attention to the following estimates by different scientific men as to the cold of stellar space: The temperature of space, Herschel, — 150°; Hopkins, — 38·5°; Fourier, — 50°; Pouillet, — 142°; Pictet, — 274°; Rankine, nothing.

Care and Management of Tools.

The following points on the management of a machine shop, which are extracted from an article in the *Tradesman*, will prove of value to those interested in this subject.

For much of the boring done in a machine shop, the upright drill, with the automatic feed, can be used to very great advantage; it has been found much more convenient than a boring lathe, and fully as efficient. A machine of this class should not be used for ordinary rough drilling; this may be performed upon a lighter and cheaper machine. For light drilling, a small, quick-running drill press, with hand feed, is suitable. By the use of universal chucks, and drills of uniform diameter throughout, including the shanks, the necessity of having a set of drills for each drill press is avoided.

Every machine shop should be provided with a tool room, but this does not necessarily imply that all of the tools should be kept there or returned each time after being used; this, in many cases, incurs a great loss of time. This rule should be observed in the case of large, valuable tools which are seldom used, but it does not apply in the case of small drills, cold chisels, wrenches, etc.; the tool room should, however, have duplicates of all tools used in the shop.

So far as possible, a regular system should be observed in the sizes of nuts, bolts and tap bolts, so that solid wrenches can be used upon them. Whenever tools require repairing, by dressing, tempering or otherwise, they should be returned to the tool room, and it should be the duty of the tool keeper to have such tools repaired and put in order without delay and returned to their places, so that there will always be a supply on hand. The old method, which allows the workman to carry the tool to the blacksmith shop and there wait until it is put in order, involves an unwarrantable waste of time.

The tool keeper must necessarily be a first-class machinist and tool maker, capable of replacing any and every tool used in the shop, and this is true even where the tools are mainly purchased, as special tools are unavoidably required occasionally in every shop. Ordinarily, every workman is supposed to keep his own tools ground and in good condition for work, but it is undoubtedly more economical to have certain tools, such as twist drills, reamers, etc., kept in order by the tool maker.

Joining Band Saws.

The following directions for joining band saws are given by the Defiance Machine Works: Bevel each end of the saw the length of two teeth. Make a good joint. Fasten the saw in brazing clamps with the back against the shoulder, and wet the joints with solder water, or with a creamy mixture made by rubbing a lump of borax in about a teaspoonful of water on a slate. Put in the joint a piece of silver solder the full size thereof, and clamp with tongs heated to a light red (not white) heat. As soon as the solder fuses, blacken the tongs with water, and take them off. Remove the saw, hammer it, if necessary, and file down to an even thickness, finishing by draw-filing lengthwise.

COAL is mined in Turkey, in Heraclea and Koslu, both on the Black Sea and about 100 miles from Constantinople. The mines at Heraclea are controlled by the Ottoman government; the Koslu mines by a private firm, Kurtschi & Co. The coal obtained is inferior in quality to the English mineral, especially to the Cardiff and Newcastle coal.

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RECENTLY PATENTED INVENTIONS.

Engineering.

FEED WATER HEATER.—Joseph Bell, Troutdale, Oregon. A casing is, according to this invention, connected at its lower part with the steam supply, and contains upwardly extending plates provided with projections, a water distributer being held above the plates and discharging thereon. A filter is arranged within the casing above the entrance of the steam supply to cause the steam to pass upward between the plates, and the feed-water is filtered after it is heated and previous to its entrance to the boiler. The invention is an improvement on a former patented invention of the same inventor.

COAL SCREEN.—James J. Coyne, Old Forge, Penn. This is an improved construction especially designed to receive anthracite coal from the breaker, screening the coal without regard to its condition as to moisture, and also brushing and polishing the coal. It consists of a rotary shaft with a series of interlocking hubs, the central hub of each series being loose on the shaft and the two outer hubs fixed to the shaft, while radial arms projecting from the loose hubs carry a tubular screen and adjustable radial arms project from the fixed hubs, brushes and blades connecting the outer ends of the arms of adjacent fixed disks.

Railway Appliances.

CAR COUPLING.—Robert S. Russell, Brownsville, Texas. Pivoted within the drawhead is a coupling jaw having a horizontal hook at its forward end and a shoulder on the lower face of the rear end, the latter being weighted, while a rock shaft journaled beneath the drawhead carries an arm adapted to contact with the coupling jaw and shoulder. The improvement affords an automatic coupler designed to be very cheap and simple, always safe, and which may be coupled and uncoupled from the side of the car, with means for locking the parts in coupled or uncoupled position.

CAR WHEEL.—George H. Graham, Oak Park, Ill. The tire of this wheel has segmental recesses on its inner surface, the spokes having segmental rings fitting into the recesses, while the hub carries bolts forming pivots engaging the inner ends of the spokes. The inner ends of the spokes are formed with an eye in which fits a rubber cylinder through which passes the bolt of the hub, forming a rubber cushion on the inner end of each of the spokes. The improvement is designed to reduce to a minimum the chances of breaking from crystallization or other causes.

Mechanical.

WIND MOTOR.—John Hoffman and Harvey F. Turner, Oakley, Kansas. This motor is of simple and durable construction, and arranged to transmit the combined force of a series of wind wheels to a common shaft. It comprises a tower in which is a central vertical shaft connected with a turn-table on the top of the tower, a rotary frame depending from the turn-table inclosing the tower, the frame having a ring on its lower end traveling about a circular track on the lower portion of the tower, while upper and lower horizontal wind wheel shafts are journaled on the rotary frame, vertically-extending shafts being geared to the horizontal shafts and in turn geared to the central vertical shaft.

OIL CAN.—Frank E. Small, Sing Sing, N. Y. This can has a flexible bottom and an upper and lower chamber, with a downwardly-opening valve controlling the communication between the two chambers, a spring normally holding the valve open, while a spout has unobstructed communication with the lower chamber. While the can is adapted for use in the ordinary ways it may also be made to eject oil with a great deal of force, to throw it to a considerable height, as may be desirable in oiling overhead mechanism or parts difficult to reach.

CUTTING GLASS PLATES.—William J. Wilson, Watford, England. Photographic plates which have been coated with sensitive emulsion are then divided into smaller plates of various standard sizes, and this invention provides a mechanism whereby the plates are held and presented in succession and in proper position to the cutting tools, the cutting then being effected by the relative motion of the plate and cutter, produced either by the movement of the cutter over the plate or the movement of the plate past the cutter.

CAN CRIMPING MACHINE.—James A. Peck, Brewster, N. Y. Simple and durable in construction and automatic in operation, this machine is designed to securely crimp the flanges of the covers on to can bodies. It has a vertically rotating carrier with an intermittent motion and having peripheral recesses to receive and discharge the cans, while there are two dies at opposite ends of the carrier to align with the recesses, and each having a beveled rim engaging the can covers, one of the dies having a rotary motion to impart a rotary motion to the can, and the other die being longitudinally movable. Bevel wheels journaled in fixed arms at opposite sides of the carrier engage the flanges of the covers opposite the beveled rims of the dies, pressing the flanges inward toward the rims.

ROD JOINT OR COUPLING.—Isaac Jones, De Lancey, Pa. A simple and durable device readily applied or removed in case it is desired to couple or unscrew two drill rods, is provided by this invention. The two members of the joint are screwed together and formed with registering recesses on their outer surface, a key sliding in one of the recesses and engaging with its projecting end the recess in the other member, while liners held in the recess of the second member engage the sides of the key, and a bolt held in the first member has a head arranged in the path of the key to lock it in place.

Agricultural.

GRAIN DRILL.—William H. Davis, Fond du Lac, Wis. This invention provides an improvement in what are known as "shoe drills," and the front or fluke frame and the rear or wheel frame are pivotally jointed, the wheels in the rear frame running one in the rear of each fluke. A lever is arranged to relieve the fluke frame of the weight of the driver when desired, or it may be adjusted to cause the driver's weight to be exerted to hold such frames down. The depth at which the shoes run to penetrate the soil and form furrows is readily adjustable, and the invention covers various other novel features.

Miscellaneous.

CASH REGISTERING MACHINES.—G. B. Massey, deceased (Sarah R. Massey and Stanley A. Bryant, administrators, Mamaroneck, N. Y.) An adding attachment is provided by this invention for a formerly patented invention of the same inventor, the improvement adding fractional parts of a dollar only, the dollars being added on the record strip of the machine. The rock shaft of the printing mechanism has a toothed sector engaging a pinion on the shaft of the number wheels, a spring pawl carried by the pinion engaging a notched wheel on the number wheel shaft, a volute spring carrying the notched wheel back after it has been moved by the pawl, while a spur wheel on the number wheel shaft carries a ratchet wheel to be engaged by the pawl, and numbering wheels with carrying mechanism are adapted to be engaged by the spur wheel on the number wheel shaft.

FOLDING CHILD'S CARRIAGE.—William Cook, New York City. The folding running gear frame of this carriage has side bars carrying stud axles on which are the wheels, and the folding body is supported on springs in the usual manner. The sides and ends of the body have pivotal connections between all their meeting ends, whereby the members of the body and the running gear frame, as well as a pivotally connected handle bar, will swing in unison and the carriage may be folded without disconnecting any of the connections. The construction is such that the stability of the carrirge, when open in position for use, is not dependent on the fastening of latches by the servant or attendant, the parts being permanently fastened together. The collapsing can be readily effected by a slight pressure on the sides of the body, but only after the hinged bottom board has been raised. When erect the carriage is not noticeably different in appearance from non-folding ones, being manufactured of wood or rattan and in various designs.

FURNITURE CASTER.—Rob Roy Parrish, Portland, Oregon. This is an improvement in casters whose pintles or pivots are held in their sockets by means of springs, thus preventing accidental detachment of the casters, while their removal may be effected by the application of more or less force. The metal socket has an internal rib, and the pintle has an enlarged shoulder within the base of the socket, a spring attached to the pintle having downwardly-projecting arms normally out of contact with the socket, and the pintle not coming into contact with the rib when thrown into an inclined position.

ASH SIFTER.—Johann G. Bast, Brooklyn, N. Y. A device more especially designed for family use is provided by this invention—one which is simple and durable in construction, easily manipulated, and adapted for use on an ordinary ash pail. A flanged receptacle with a screen bottom fits in the upper part of the pail, the flange resting and turning on the edge of the pail, the receptacle having a fixed top part and a hinged lid locked by a bolt, while a covering strip is provided for covering the joint between the lid and the fixed top part.

FIREPLACE BLOWER.—Gutie H. Tuttle, Shorter's Depot, Ala. Vertical rods at the side of the fireplace pass through a cap fixed at the top, and an apron or curtain of fireproof material is secured at its upper end to the inside of the cap, eyes on the sides of the apron sliding on the rods. A handled bar on the lower end of the apron also slides on the rods, and may be locked to hold the apron down, springs normally drawing the apron into the cap. The blower is designed to be readily raised or lowered to increase or diminish the draught, while being very ornamental in appearance and suitable for use as a screen in summer time.

PORTABLE BATH.—Alfred H. Cox and Isaac N. Haley, New York City. This is a simple, compact, and convenient device, which may be collapsed to form into a small package for carriage, and affords means to administer a shower or other bath of warm or cold water in a room without injury to carpets or furniture. The tub has a convex bottom from which extends a drain pipe, there being rigging for raising and lowering the tub, and a water-proof screen wall being suspended from above the tub and attached to it by its lower edge. A clean water supply device having a spray nozzle is adapted to discharge water near the top of the screen wall.

ROPE REEL.—Hermann O. Kunath, Evansville, Ind. This is an inexpensive device which may be made of waste pieces or strips of wood, and consists of two crossed inclined pieces, centrally secured together, to which, a short distance from their ends, are secured side and end pieces, one of the side pieces forming the handle. The improvement affords a strong form of construction, the reel not being liable to be broken by hard or common use, and not being likely to split or warp from changes in the weather.

STAND FOR SIDEBOARDS, ETC.—Ferdinand K. Maximilian, New York City. This is designed as a new article of manufacture, comprising a mirror having a suitable backing and so made as to size and form as to serve as a stand or support for glasses on sideboards, hotel bars, etc., the construction being such that any form of lacquered backing plate may be used, and the cost of manufacture thus lessened.

CHECKREIN WORKER AND HOOK.—Oliver Kennedy, Brunswick, Ga. This is a simple device applicable to any harness for use in connection with an ordinary check rein, to enable the driver to check or uncheck the horse without leaving the carriage. Attached to the saddle is a base plate carrying side arms in which are rollers serving as guides for the operating rein, while on the rein end of the plate is a keeper having a pawl adapted to engage a catch riveted to the rein. When the horse is to be unchecked, the pawl is raised and the check released by pulling backward on and then slowly releasing the rein, quickly loosening the rein after pulling back causing the pawl to engage the catch and hold the horse checked.

ROLL PAPER HOLDER AND CUTTER.—Edwin E. Sentman, Philadelphia, Pa. This is a device adapted to contain wrapping paper or toilet paper in rolls, the holder being so constructed that the loose end of the paper will be always readily accessible, and the paper may be quickly and conveniently cut in desired lengths. By a novel construction and combination of parts, the roll is readily placed in the holder and the the reel removed therefrom, and, by means of a simple tension device, the roll may be more or less tightly held, to turn more or less freely.

BOX.—Frank H. Palmer, Brooklyn, N. Y. A single piece of spring wire, secured at one end to the box body, forms a convenient handle, and is so bent that its other end holds the lid, a convenient box being thus formed for holding shoe blacking, grease, and similar substances, so that the user can quickly remove and replace the cover without soiling the hands.

SASH RAIL FASTENER.—Lorenzo M. Bronson, Richmond Hill, N. Y. This invention provides a sash lock to be applied to the meeting rails of window sashes, designed to operate automatically to lock the sashes and draw them together when the window is closed. Two registering cases are secured to the meeting rails, and a weighted tumbler having teeth pivoted in the upper sash is adapted to protrude into the lower sash, while spring-pressed arms pivoted in the lower case are adapted to engage the teeth of the tumbler.

WINDOW SHADE FIXTURE.—George Biehn, Tacoma, Washington. This invention provides a sliding plate with an arm and head connected therewith to form a sliding bracket, with other novel features, a clamp and bracket being arranged on each side of the window frame, adjustable for a shade roller of any ordinary length. The device is simple and inexpensive, may be secured to a window frame of any kind without the use of screws or nails, and easily adjusted to hold a shade at any desired height, while it can be almost instantly put up or taken down.

ZITHER.—Vetal Bessier, Brooklyn, N. Y. The fret board of this instrument is hollowed out on its under side and has its front edge fastened to the front edge of the sounding board, so that the hollowed-out portion extends transversely over and clear of the sounding board to form a clear space for the full development of the sounds. A metallic frame is also secured to the sounding board, its two parallel ends forming the pitch and tuning pin plates, and the sides extending over the board and attached at their ends to the frame ends. The finger rest is made adjustable lengthwise of the instrument, to allow it to be set more or less to the right hand to accommodate different sized hands of children or adults, while allowing them easily to finger the strings at the proper places.

BRACE FOR PIANO KEY BOTTOMS.—Herman McClellan, Toronto, Canada. This brace has a vertical member shaped at its lower end as an inverted truss and having on its inner face a longitudinal rib, a horizontal member integral with the upper edge of the vertical member extending over the rib, which is adapted for engagement with the under face of the key bottom, the horizontal member engaging with its upper face. With this improvement the key bottom of an upright piano may be constructed of wood and the bottom preserved in perfect form, being effectually prevented from warping, while the brace is light in weight, strong, quickly applied, and does not interfere with the keyboard or the action.

VENTILATOR FOR HATS.—Martin F. W. Kochner, Brooklyn, N. Y. A face plate and back plate are applied on the inside and outside of an opening made in the crown of the hat, and a shutter with openings is held to revolve between the plates, or be adjustably held in any desired position. The device is especially applicable to the side, more or less air being admitted to the interior of the hat crown as desired, or the ventilator being closed to exclude the air entirely.

STIPPLING IMPLEMENT.—John B. Pabl and John B. G. Gaudelas, New York City. This is a light and convenient implement contisting of a handled frame carrying a pivoted impression roller with a papillary surface, and sliding ink-distributing rollers and sliding ink supplying fount, springs pressing the fount toward the impression roller, with the distributing rollers located intermediately. The device is adapted for the production of artistic effects upon lithographic stones or other material that is to be subsequently etched.

ANKLE SUPPORT FOR SKATES.—Luke W. Kenney, New York City. A U-shaped body is adapted to be secured to a flange of the heel plate of the skate, the members of the body extending upon each side of the ankle, and pivoted yokes extending forward and rearward from the upper ends of the members, straps from the yokes passing around the leg just above the ankle. The device is very simple and quickly applied, and allows free motion in a heel and toe direction while preventing a lateral motion likely to dislocate or strain the ankle.

DESIGN FOR A PIN.—Julius A. Bidwell, Ivanpah, Cal. This design consists of a circular figure apparently embossed upon a semicircular figure, one appearing to support the other, there being a dollar sign ($) upon the full figure and a portion of a similar sign on the other figure.

DESIGNS FOR A BADGE.—Charles A. Ball, Marion, Ind. Two design patents for badges have been granted this inventor. In one, on both the obverse and reverse sides, a dove rests on a floral spray of golden rod, the dove and the golden rod surmounting a ribbon-like pannel decorated with the U. S. coat of arms, while suspended from the panel is a disk representing on one side the landing of Columbus and on the other side the Woman's Building of the Columbian Exposition. In the other badge, an eagle with an olive branch is crouching above a ribbon-like panel in which is the U. S. coat of arms, while suspended beneath is a disk showing on one side the landing of Columbus, and on the other side the Administration Building of the Columbian Exposition.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS AND PUBLICATIONS.

VALVE GEARS FOR STEAM ENGINES. By Cecil H. Peabody. New York: John Wiley & Sons. 1892. Pp. v, 128, with 33 additional folding plates. Price $2.50.

The plain slide valve, shifting eccentrics, link motions, radial valve gears, double valve gears, and drop cut-off valve gears are the headings of the topics of this book, as summarized in the contents. The subjects are treated from a practical standpoint, mathematics, however, being used where desirable. The numerous plates are of very material advantage, and the text closes with an index.

BOYD'S COPARTNERSHIP AND RESIDENCE BUSINESS DIRECTORY OF PHILADELPHIA CITY. Boyd's Directory Office, Philadelphia, Pa.

The business interests of Philadelphia are admirably represented in this volume. Its two main divisions are an alphabetical directory of business houses, followed by a directory of the same classified by the natures of the businesses. This is followed by the city register and street directory, the whole making a most creditable representation of the business world of our Pennsylvania neighbor.

HOW TO LIGHT A COLLIERY BY ELECTRICITY. By Sydney F. Walker. London: Whittaker & Co. New York: Macmillan & Co. 1892. Pp. 36. No index. Price 75 cents.

This is a reprint from the transactions of the British Society of Mining Students, and appears to be a very practical treatment of the subject of the lighting of coal mines by the incandescent electric light.

SCIENTIFIC AMERICAN

BUILDING EDITION.

JULY NUMBER.—(No. 81.)

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3. Perspective view and floor plans of a brick house at Chambersburg Pa., recently designed and built at a cost of $2,500.
4. A cottage near Orange, N. J., from plans prepared by Munn & Co., architects, New York. Cost $7,000 complete. Perspective view and floor plans.
5. A residence at Portland, Me., erected at a cost of $5,575 complete. Floor plans and perspective elevation.
6. A residence at Bensonhurst, Long Island. Cost $9,800 complete. Messrs. Parfitt Bros., architects, Brooklyn, N. Y. Two perspective elevations and floor plans.
7. Perspective elevations and interior views of the American Yacht Club House, at Milton Point near Rye, N. Y. A handsome building of the Queen Anne style. Messrs. E. A. Sargent & Co., architects, New York.
8. A dwelling at Upper Montclair, N. J., erected at a cost of $7,000 complete. Messrs. Munn & Co., architects, New York. Perspective and floor plans.
9. A cottage at Babylon, Long Island, N. Y., erected at a cost of $3,700 complete. Plans and perspective elevation.
10. Sketch of an Australian bush home. Cost from $1,200 to $1,500. A simple and economical design for a summer house.
11. Miscellaneous contents: Electrical cotton gin.—Aluminum.—The efflorescence on brickwork.—Leaf photography.—Car roofing.—Superior steel furnaces, illustrated.—How to stain wood yellow and gray.—Ink for writing on glass or porcelain.—An improved wood-working machine, illustrated.—An improved revolving chimney top, illustrated.—Elevators in the amphitheater of Rome.—An improved hot water heater, illustrated.—Natural wood grille and screen work, illustrated.—Galvanized eaves troughs and conductors, illustrated.—Sliding blind patents.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(4446) W. J. H. says: Please inform me if there is any way to prevent a boiler from priming. Would you advise using potatoes for removing scale. If so, would 20 pounds be more than advisable for a 60 horse power tubular boiler, cut small and dropped in in the steam drum? I would like to have your idea about using coal oil for removing scale in boilers. A. The priming of a boiler may arise from incrusted tubes or dirty water, which lessens steam production, or possibly from overtaxing its capacity. Although potatoes are said to have been used for removing scale in boilers, we have too little faith in their efficiency to recommend them. Coal oil has the tendency to gather the dirt into a cake, which is liable to settle on the fire sheet and injure the boiler. The easiest to obtain and cheapest boiler cleaner is the ordinary sal soda or crystallized washing soda. One half pound to a boiler horse power, dissolved in the feed water and pumped into the boiler, where, after a day's boiling in the regular use of the boiler, it can be blown out by repeated filling up and blowing down three cocks at a time, while the boiler is running. Repeat and clean out the boiler.

(4447) H. M. T. asks: 1. If cocaine were applied to one spot of the body frequently, would it kill the nerves at that place? A. No. 2. What work on psychology would you recommend for the general reader? A. We recommend and can supply Sully's "Outlines of Psychology," price $3 by mail post paid, also Munsell's "Psychology," price $1.75.

(4448) T. H. says: 1. There is a spring coming out of a precipitous hill 250 feet from its base. It fills a 1½ inch pipe. There is anxiety to know what horse power could be developed if it were brought to the base in a perpendicular pipe if properly handled. Also how much less would be the power if brought down in three perpendicular sections, that is a horizontal pipe from the bottom of one to top of another? Also what horse power at a grade 22½°. Has a hammer with a sharp screw thread in the eye for receiving the handle ever been known or is it now original? If distilling water will not remove the odor of volatile matter, how can it be said that distillation can purify it? A. We cannot rate the power of a spring without knowing the quantity of water flowing in gallons or cubic feet per minute, or the length of the pipe and the vertical height of the spring above the point of discharge, which must be open to the full capacity of the pipe. A direct line of pipe down the slope of the hill will give the greatest efficiency over the other line, as stated. We have no knowledge of a hammer with a screw eye. Distillation purifies water by separating mineral and organic matter from the distillate. Odors, if not eliminated by open boiling, may be absorbed by filtration through animal carbon.

(4449 H. B., Munich.—In regard to your numerous queries, we assure you that the United States naval authorites are thoroughly posted as to all the known improvements in naval armament, both for offence and defense. All the steel alloys have been tested and the nickel steel found to be the best for all purposes. The Mannesman tube process has not yet been made practicable for the great-gun tubes.

(4450) D. E. S., Eaton, O., says: Early in the spring of this year water works were put in operation here, the supply of water being taken from ten wells drilled 100 feet deep in a sandy loam near a creek. The wells are cased up with iron pipe. Up to a month ago the water seemed as fine for drinking purposes as any I ever saw, being slightly soft. For the past month the water has been tasting bad and has been getting worse. When drawn out of the hydrant it strongly resembles milk in appearance. A glass full will clear in about two minutes, leaving no sediment. By holding the glass to the ear a singing noise similar to that produced by soda water is heard, and quite a vapor or steam will rise. By holding a lighted match in this vapor the flame will brighten up perceptibly. The water smells and tastes like oil. Is the water healthy, or how can we test it (some simple way) to find what is the matter with it? After the water settles an oily substance can be seen on the surface. Would the water in our wells be as healthy or more so than the hydrant water? Population 3,500, closely built, no sewers, land flat, too much so for cellars. Will the water likely improve? The county infirmary is located a half mile up the creek from the wells, with its sewer emptying into the creek. Would that contaminate the wells? A. The indications are that you have gas or oil at a lower depth than the wells, and that the pumping has drawn the gas or oil into the water stratum. The singing noise is probably the gas escaping from the water. The water may not be injurious or unhealthy, yet we cannot say that it is healthy, but the taste and smell condemn it. The sewage from the county infirmary will not contaminate the wells, as the filtration of the creek water through the soil will purify the water. We should judge the well water better than the hydrant water, provided that the wells are at a distance from water closets and cesspools. It is very doubtful if your deep well water improves. Probably a new set of wells nearer the creek and not so deep, say 50 feet, and at quite a distance apart, will give you better service. The filtrate from the creek is better than the present supply.

TO INVENTORS.

An experience of forty years, and the preparation of more than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. A synopsis of the patent laws of the United States and all foreign countries may be had on application, and persons contemplating the securing of patents, either at home or abroad, are invited to write to this office for prices which are low, in accordance with the times and our extensive facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN, 361 Broadway, New York.

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June 28, 1892.

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

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Wood working machinery or machines, Berlin Machine Works 21,391
Yarn and thread, linen and hemp, Finlayson, Bousfield & Co 21,356, 21,392

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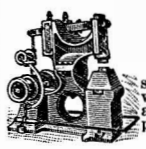

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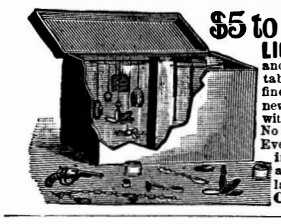

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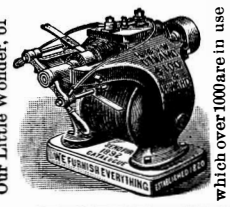

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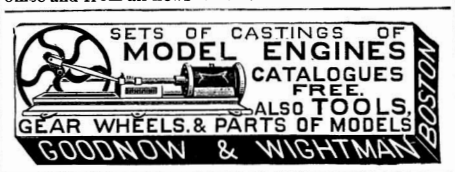

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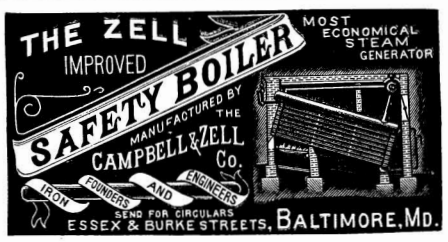

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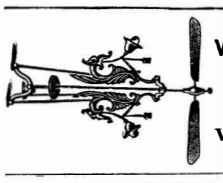

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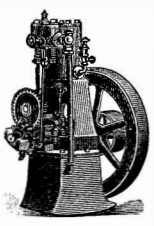

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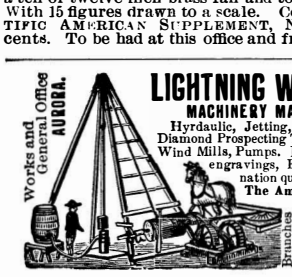

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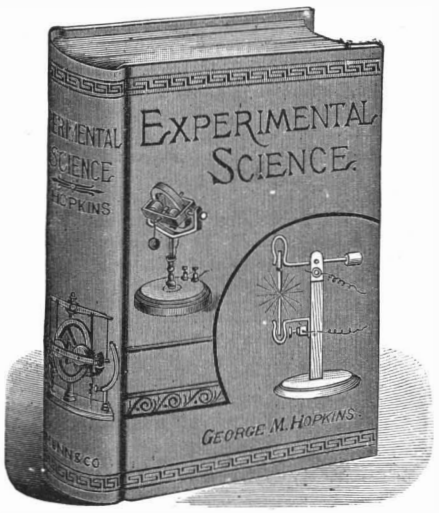

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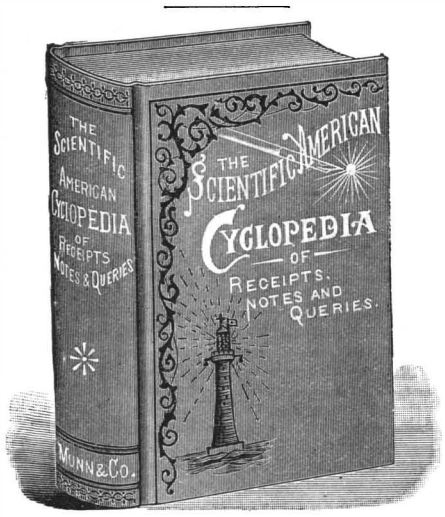

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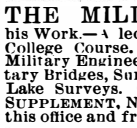

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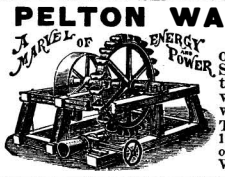

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Lands and Works Department,
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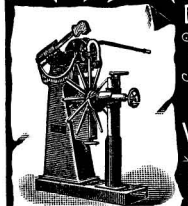

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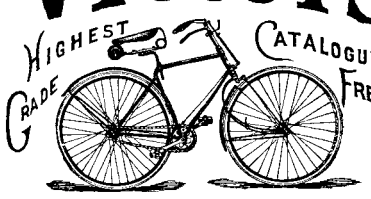

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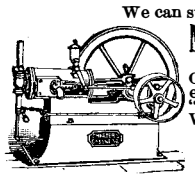

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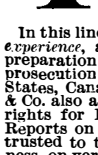

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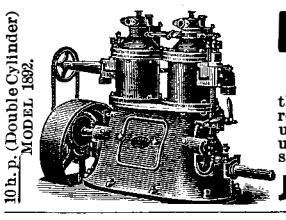

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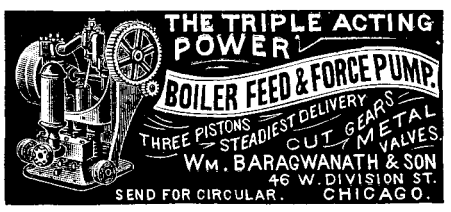

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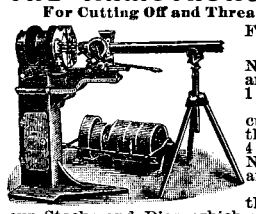

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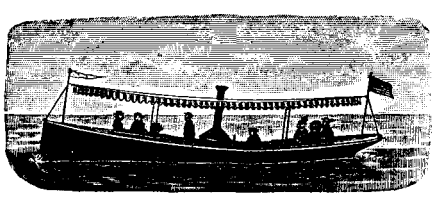

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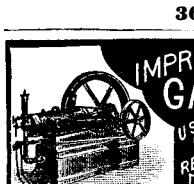

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